



**TeeJay
Publishers**

Mathematics

Curriculum for Excellence
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Book 3a

a cornerstone in Scottish Education

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First Edition published by TeeJay Publishers - June 2012

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Level 3a Textbook

Produced by members of the TeeJay Writing Group

T Strang, J Geddes and J Cairns.

PUPIL BOOK

≡ 3a ≡

CfE Level 3a Textbook

Book 3a can be used in the upper stages of Primary or in Secondary 1/2 with pupils who have successfully completed CfE Level 2, and along with Book 3b, covers the entire content of CfE Level 3.

- Most pupils will complete the contents of book 3a during Secondary 1 and hopefully Book 3b during Secondary 2.
- There are no A and B exercises. The books cover the **entire Level 3 CfE course** without the teacher having to pick and choose which questions to leave out and which exercises are important. They all are !
- Pupils who cope well with the contents of Level 3 should commence work on the National 5 Course late in S2 or early S3.
- The book contains a 6 page "**Chapter Zero**" which primarily revises every strand from CfE Level 2 and can be used as a diagnostic tool. This could be followed by **TeeJay's** diagnostic assessments * of the work of Level 2.
- Chapter 16 is a Revision of all the work from Level 3 covered in Book 3a, prior to moving on to **TeeJay's Book 3b**.
- The Index indicates when the curricular content has been covered allowing pupils to attempt Teejay's Individual **Outcome Assessments***.
- Non-calculator skills are emphasised and encouraged throughout the book.
- Each chapter will have a "**Revisit - Review - Revise**" exercise as a summary.
- Homework will be available as a photocopiable pack.
- **TeeJay's Assessment Pack*** for each Level, early to 3, is already available and can be used topic by topic or combined to form a series of Level 3 cumulative Tests.

Pupils should then be able to complete their National 4/5 course leisurely by the end of S3 or in S4.

We make no apologies for the multiplicity of colours used throughout the book, both for text and in diagrams - we feel it helps brighten up the pages !!

T Strang, J Geddes, J Cairns

(June 2012)

* Available for purchase separately.

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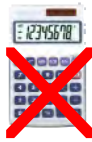
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* Topics listed with a star have been brought forward from Level 4 - We believe they lie better in Level 3.

CHAPTER 0

Revision

Revision of CfE Level 2 Work

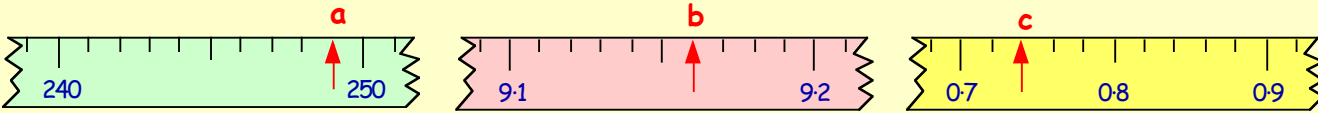


unless specified.

Revisit, Revise
and Recall the
contents of CfE
Level 2

Exercise 1

1. Round to the nearest 1000 :- a 7395 b 49501.
2. Copy and complete :- The answer to $7194 + 1985$ is about $7200 + \dots\dots$ which equals $\dots\dots$.
3. Write the number that comes :- a 200 after 7900 b 500 before 13 400.
4. Write the number 870 060 in words.
5. Find the following :-
a
$$\begin{array}{r} 2980 \\ + 560 \\ \hline \end{array}$$
 b $23\,709 + 4093$ c
$$\begin{array}{r} 6000 \\ - 1589 \\ \hline \end{array}$$
 d $20\,300 - 7\,946$.
6. Find the following :-
a
$$\begin{array}{r} 4163 \\ \times 8 \\ \hline \end{array}$$
 b $30\,060 \times 7$ c
$$\begin{array}{r} 5 \overline{) 9345} \end{array}$$
 d $82\,548 \div 6$.
7. Eight cartons of milk contain 4544 millilitres.
How much does each carton contain ?

8. To what numbers do these arrows point ?

9. Write down the answers to the following :-
a 1820×100 b $960\,000 \div 1000$ c 231×3000 d $8\,320\,000 \div 4000$.
10. George is thinking of a number.
When he subtracts 200 and then divides by 10 the answer is 80.
What is the number George is thinking of ?

11. Round :-
a 26.735 to the nearest whole number
b 13.147 to 1 decimal place
c 5.0983 to 2 decimal places.
12. Do the following :-
a $37.9 + 4.64$ b $103.72 - 49.8$ c 9.03×8 d $53.46 \div 3$.

13. Find :-

a 19.82×10

b $34.7 \div 100$

c 2.405×100

d $4050 \div 1000$.

14. Find :-

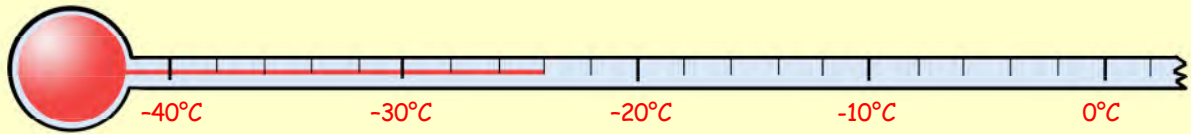
a $10 - 4 \times 2$

b $(10 - 4) \times 2$

c $9 + 6 \div 3 - 2$

d $(9 + 6) \div 3 - 2$.

15. What is the temperature on this thermometer ?



16. Find :-

a $6 - 11$

b $-4 + 9$

c $6 + (-10)$

d $(-9) - 1$.

17. Write down the next **two** numbers in these patterns :-

a 27, 31, 35, 39, ...

b 80, 73, 66, 59, ...

c 23, 18, 13, 8, ...

d 1, 2, 4, 8, ...

18. Write down the first five **multiples** of 8.

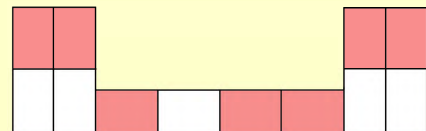
19. Write down all the **factors** of 20.

20. Write down :-

a the **highest common factor** of 30 and 42

b the **lowest common multiple** of 6 and 10.

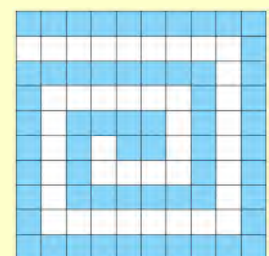
21. What **fraction** of this shape is coloured **pink** ?



22. What **fraction** of these coins are copper ?



23. What **percentage** of this square has been coloured blue ?



24. At a birthday party, 55% were women and 35% were men.

The rest were their children. What **percentage** were children ?

25. Write down any **fraction** equivalent to :-

a $\frac{3}{5}$

b $\frac{5}{7}$.

26. Simplify as far as possible :-

a $\frac{14}{21}$

b $\frac{18}{45}$.

27. What is :-

a $\frac{1}{3}$ of 45 m

b $\frac{4}{5}$ of £2.50

c $\frac{5}{8}$ of £2.40 ?

28. Re-write these numbers in order, starting with the **smallest** :- $\frac{3}{4}$, 80%, 0.7.
29. Express 24% as a **fraction**, simplifying it as far as possible.
30. Find :- **a** 10% of £12 **b** 25% of £3.60 **c** 5% of £80.
31. 24 out of the 40 cars in a car park are French made. What **percentage** is this ?

32. Mrs Holmes took her 2 children to the cinema. She had £35 with her.
Her ticket was £11.50 and each child ticket was £6.25.
She also spent £8.25 on popcorn and drinks.



Will she have enough for the bus fares home costing £3.20 ? (Explain your answer).

33. Which of these packs of pears gives the better deal ? (Explain your answer)



£1.24



£1.98

34. I went to America and changed £300 into dollars when the rate was :-
How many dollars did I receive ?

£1 = \$1.60

35. A newsagent bought in 8 copies of a new magazine for £17.50.
She sold them all to her customers priced at £2.75 each.
How much **profit** did she make altogether ?



36. A TV film ended at 22:10. Write this in 12 hour form, using am or pm.
37. A CD track lasted for 3 minutes 15 seconds. How many seconds was that ?
38. I walked to the post box in 6 mins 35 secs and the return journey took me 5 mins 55 secs.
How long did it take me **altogether** ?

39. Bonny swam the 800 metre race in 10 mins 9.55 seconds.
Jenny swam it in the time shown on the stopwatch.
Who was faster and by how much ?



40. My plane left Inverness at 13:50 and touched down in London at 15:35.
How long had my flight lasted ?

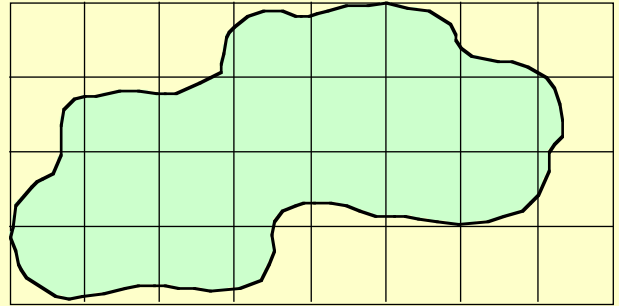
41. I drove the 300 miles from Glasgow to Wick in the North of Scotland.
It took me exactly 5 hours on my motorbike.
Calculate my **average speed**.



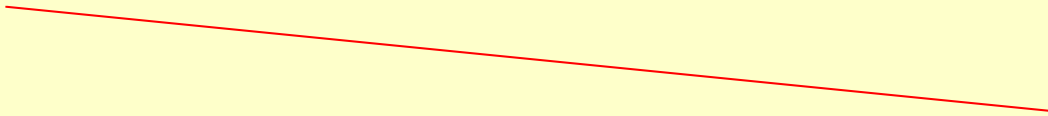


Estimate the **length** of a **real** umbrella in centimetres.

43. Estimate the **area** of this shape, in cm^2 .



44. **Measure** this line and express your answer in 3 different ways.



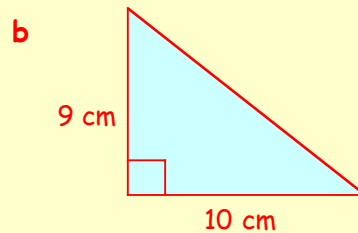
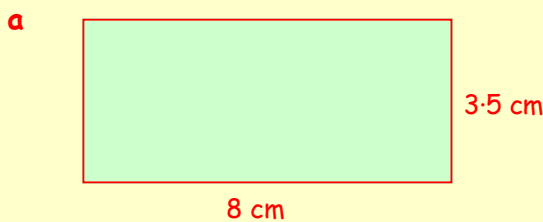
45. Change 306 centimetres to **metres** and **centimetres**.

46. Change 5 kilograms 70 grams to **grams**.

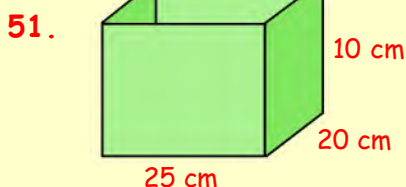
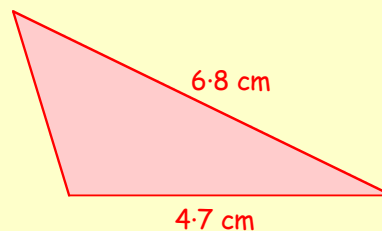
47. How many **millilitres** are there in $3\frac{1}{2}$ litres ?

48. Ian jogs the $2\frac{1}{4}$ kilometres to his sports ground, then runs **twice** round the 400 metre track. How far has Ian run **altogether** ?

49. Calculate the **area** of each of these shapes :-



50. The **perimeter** of this triangle is 15.1 cm. Calculate the length of the 3rd side.



- a Calculate the **volume** of this container in cm^3 .
- b How many **litres** will it hold when full ?

52. This table shows the number of kilometres (k) I walked and the time taken (T), in minutes. Find the **formula** connecting T and k .

Distance in kilometres (k)	1	2	3	4	5
Time taken in minutes (T)	9	18	27	36	45

$T = \dots\dots\dots$

53. This table shows the connection between the weight (W) grams of a box containing various numbers of tennis balls (T). Find the **formula** connecting W and T .

Number of tennis balls (T)	1	2	3	4	5
Weight in grams (W)	130	180	230	280	330



$W = \dots\dots\dots + \dots\dots$

54. Solve these equations for x :-

a $x + 7 = 15$

b $3x = 21$

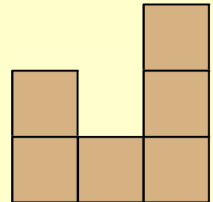
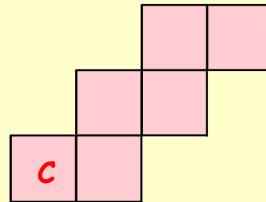
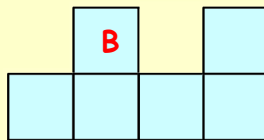
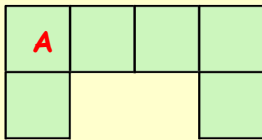
c $2x - 4 = 11$.

55. Write down all the solutions for $p \leq 2$ from the set of possibilities :- $\{-3, -2, -1, 0, 1, 2, 3\}$.

56. Write down 2 main **differences** between a rectangle and a parallelogram.

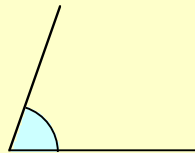
57. How many **edges** has a square based pyramid ?

58. Which one of these **IS** the net of a cube ?

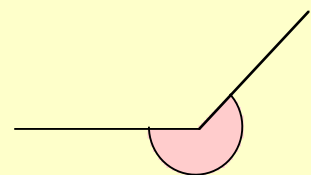


59. What **type** of angles are these ?

a

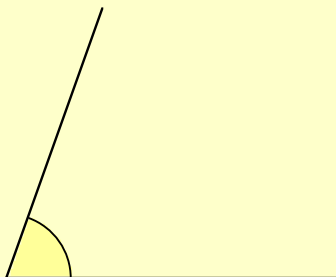


b

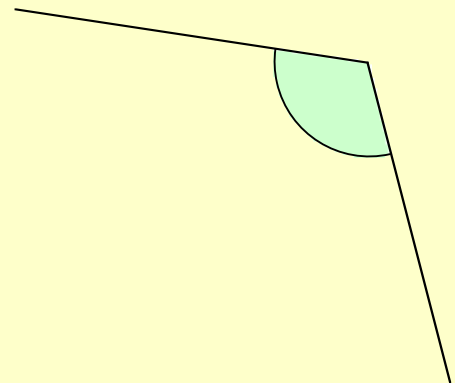


60. **Measure** these angles and write down their sizes :-

a

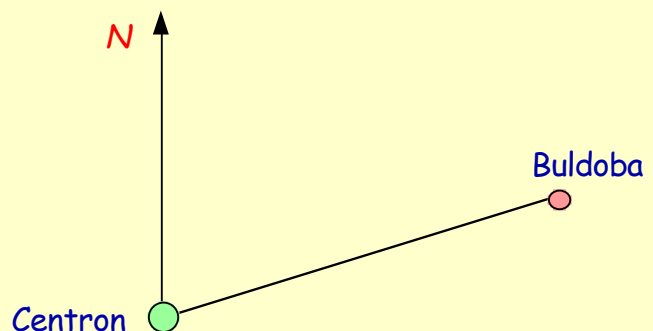


b

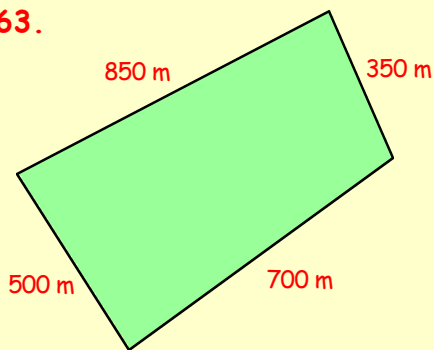


61. On a compass, what direction is directly opposite **South East** ?

62. Measure and write down the **bearing** of Buldoba from Centron.



63.

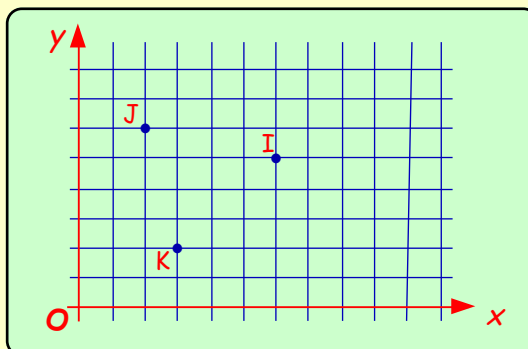


This sketch shows a plot of land where houses are to be built.
A scale drawing of this plot of land has to be made **on this page**.
Which would be the **most appropriate** scale to use ?

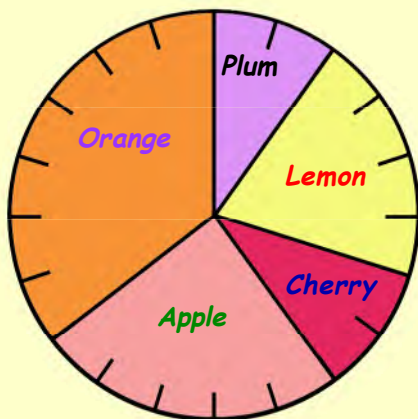
- A 1 cm = 25 m B 1 cm = 50 m
C 1 cm = 10 m D 1 cm = 1 m ?

64. a Write down the **coordinates** of point I.

b Write down the **coordinates** of a 4th point, (call it L), so that **IJKL** is a rhombus.



65.



This pie chart shows the number of different types of trees that are growing in an orchard.

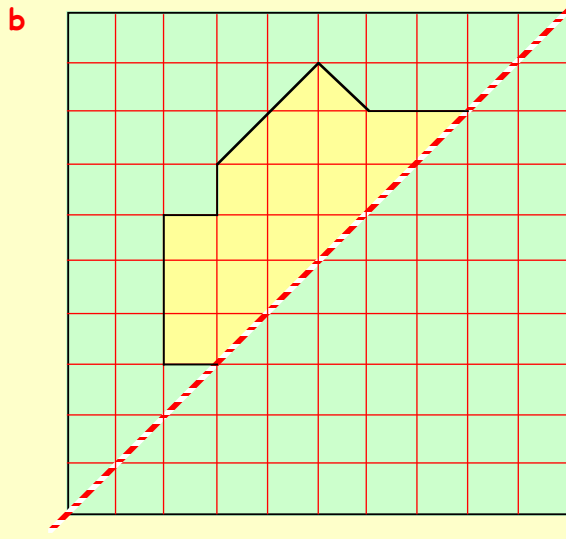
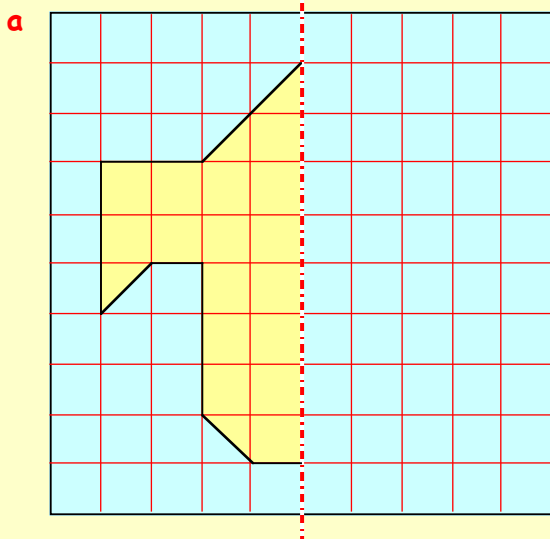
- a What **percentage** of them are apple trees ?
b There are 300 trees in the orchard.
How many apple trees are there ?

66. These cards are shuffled, turned upside down and placed in a pile.
If I choose the top card, what is the **probability** it will be an ace ?



67. If the probability it will snow tomorrow is 0.13, what is the **probability** it will **NOT** snow ?

68. **Copy** and **complete** both shapes so that the dotted line is a **line of symmetry**.



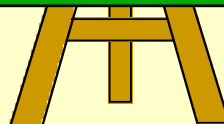
CHAPTER 1

Rounding

Round to any number of Decimal Places

In book 2b, you learned how to round a number to the nearest 10, 100 or 1000 by deciding which multiple of 10, 100 or 1000 the number was closer to.

Be able to
round a number
to any
decimal place



When rounding to :-

- 1 Decimal Place** look at the **2nd** decimal figure. e.g. 5·**1**38
- 2 Decimal Places** look at the **3rd** decimal figure. e.g. 7·45**1**7
- 3 Decimal Places** look at the **4th** decimal figure. e.g. 11·513**2**9
- 4 Decimal Places** look at the **5th** decimal figure. e.g. 0·7617**9**81.

if this figure is a 5, 6, 7, 8 or 9 => round the digit **before** that figure **UP** by 1.
if this figure is a 0, 1, 2, 3 or 4 => **leave** the digit before it as it is.

Example :- Examine the decimal number 4·2615937.

Rounded to 1 dec. pl.	4·2 6 15937 = 4·3	(a "6", so round the "2" UP)
Rounded to 2 dec. pl.	4·26 1 5937 = 4·26	(a "1", so leave the "6" as it is)
Rounded to 3 dec. pl.	4·261 5 937 = 4·262	(a "5", so round the "1" UP)
Rounded to 4 dec. pl.	4·2615 9 37 = 4·2616	(a "9", so round the "5" UP).

Exercise 1

1. Round each of these numbers to **1 decimal place** :-

- | | | | |
|----------|-----------|-----------|-------------|
| a 4·24 | b 3·48 | c 6·451 | d 7·2923 |
| e 9·351 | f 0·5199 | g 10·946 | h 8·9913 |
| i 10·555 | j 0·94999 | k 19·9512 | l 99·99111. |

2. Round each of these numbers to **2 decimal places** :-

- | | | | |
|----------|----------|-----------|------------|
| a 7·583 | b 9·627 | c 3·98512 | d 5·3991 |
| e 0·2451 | f 13·484 | g 9·0523 | h 4·9926 |
| i 9·951 | j 0·5199 | k 9·996 | l 99·9953. |

3. Round each of these numbers to **3 decimal places** :-

- | | | | |
|-----------|------------|------------|------------|
| a 8·7923 | b 11·5047 | c 0·2987 | d 215·4025 |
| e 2·45712 | f 10·08082 | g 34·99912 | h 2·99999. |

4. Round each of these numbers to the number of decimal places in the brackets :-

- | | | | | | | | | |
|---|---------|-----|---|---------|-----|---|---------|------|
| a | 24.54 | (1) | b | 1.765 | (2) | c | 0.8156 | (3) |
| d | 8.7654 | (2) | e | 9.789 | (2) | f | 0.55555 | (3) |
| g | 10.1469 | (2) | h | 0.54321 | (4) | i | 11.631 | (0) |
| j | 1.99999 | (3) | k | 23.7684 | (2) | l | 99.99 | (1). |

5. Use your calculator to carry out each of these calculations, then round to **2 decimal places** :-

- | | | | |
|---|-------------------|---|---------------------|
| a | $3.157 + 7.998$ | b | $26.954 - 17.895$ |
| c | $14.795 + 5.2$ | d | $134.37 - 72.478$ |
| e | $14.795 \div 5$ | f | 26.9×37.84 |
| g | $14 \div 9$ | h | $434.3 \div 72.4$ |
| i | 3.17×7.8 | j | 16.9×17.84 |
| k | $114 \div 17.6$ | l | $134.3 \div 42.4$ |



6. Do these calculations, then round each answer to the number of decimal places shown in the brackets :-

- | | | | | | | | | |
|---|---------------------|-----|---|----------------------|-----|---|-------------------------------|------|
| a | 4.67×0.358 | (3) | b | 0.254×9.777 | (2) | c | 8.847×2.584 | (3) |
| d | $0.29 \div 4.145$ | (4) | e | $17.35 \div 19.887$ | (1) | f | $0.3 \times 0.24 \times 0.99$ | (4). |

7. Quite often, taken in context, the rules of rounding do not apply.

- a Seven people share £6. How much does each receive ? ($600 \div 7 = 85.71\dots p$)
By rule of rounding, each should get 86p but $86p \times 7 = \text{£}6.02$ (more than £6 !)
Taken in context, they cannot get 86p what is the most each can get ?
- b Share £8200 amongst 9 people. How much can each get ?
- c How much will each person get if 7 people share £1000 equally ?



d A lift can hold a maximum of 8 people.
There are 26 people in a queue for the lift.
Jake calculates that the lift will take **three** journeys, since $26 \div 8 = 3.25$ which rounds to 3.
Explain what Jake has done wrong.

8. You cannot pay 0.9 of a pence.

Discuss or investigate why petrol stations charge 149.9p per litre or a kilowatt of gas costs 3.7p.



Rounding using Significant Figures

Be able to round a number to any given significant figure.

In mathematics, a figure or digit in a number is "significant" if it gives some sense of **Quantity & Accuracy**.

"Zeros" can be complicated -

when do we count them?

when do we ignore them?

If zeros are used only to show where the position of the decimal point is, then they are NOT significant.

Example 1 :-

503 has 3 significant figures

50.3 has 3 significant figures

5.03 has 3 significant figures

0.503 has 3 significant figures

0.05030 has 4 significant figures

(The front zero positions the decimal point, BUT trailing zeros shows accuracy).

Example 2 :-

8275 rounded to 1 significant figure

=> 8000

13 232 rounded to 3 significant figures

=> 13 200

1.5579 rounded to 3 significant figures

=> 1.56

0.007 762 rounded to 2 significant figures

=> 0.0078

Exercise 2



1. How many significant figures does each number have in the following context :-

- a There are **200** pennies in £2.
- b The official attendance at the Renfrew v Arthurlie match was **5000**.
- c The cost of a glossy magazine is exactly £**4.70**.
- d There are **360°** in a complete turn.
- e The weight of a packet of biscuits is about **1.2** kilograms.
- f There are **172 800** seconds in 2 days.
- g The volume of a medium-size bottle of water is **600** millilitres?

2. Write down how many **significant figures** there are in each of these numbers :-

- | | | | |
|-------------|-------------|-------------|-----------------|
| a 23.0 | b 9.00 | c 1.001 | d 456 |
| e 50.2 | f 212.7650 | g 29.10 | h 0.591 |
| i 0.043 | j 1.000 005 | k 0.030 20 | l 0.000 70 |
| m 90.000 10 | n 233.000 | o 0.000 007 | p 0.000 000 60. |

3. Round each number to **1** significant figure :-

- | | | | |
|----------------|-----------------|-------------------|-----------------|
| a 52 | b 374 | c 7229 | d 67187 |
| e 3199 | f 2799 | g 4.73 | h 0.056 |
| i 0.654 | j 0.0067 | k 0.000741 | l 29.12. |

4. Round each number to **2** significant figures :-

- | | | | |
|----------------|-------------------|------------------|------------------|
| a 306 | b 7149 | c 20900 | d 452135 |
| e 36.57 | f 46.64 | g 8.183 | h 0.321 |
| i 0.496 | j 0.005594 | k 0.03433 | l 39.112. |

5. Round each number to **3** significant figures :-

- | | | | |
|-------------------|------------------|-------------------|--------------------|
| a 4583 | b 36076 | c 99456 | d 456399 |
| e 9.321 | f 22.817 | g 0.451345 | h 0.765198 |
| i 0.004615 | j 0.01093 | k 0.03487 | l 0.099999. |

6. Find the weight of a box of 144 blank DVD's if each DVD weighs 48 grams.
(Give your answer in grams to 2 significant figures).

7. What is the total volume, in millilitres, of 85 bottles of juice each containing 275 ml ?
(Give your answer in millilitres to 3 significant figures - sig. figs.)

8. My bank interest for a year worked out at 3.4% of £37450.
Calculate my interest, correct to 2 sig. figs.

9. Jemma's garage bill came to £1227.13 + VAT at 20%.
($20 \div 100 \times £1227.13$).

Calculate the VAT, correct to 5 sig. figs.



10. Calculate, correct to 3 sig. figs., the total price on :-

- a** £176 + VAT **b** £22763 + VAT **c** £2342 + VAT. (all at today's VAT rate).

11.



The total annual wage bill for the 19 employees at Ray's Restaurant came to £364 786.

Calculate the average wage of each employee, to 2 sig. figs.

12. A bottle of mustard weighs 0.475 kg.

Round this weight to 1 sig. fig. and **estimate** the total weight of 400 bottles.



Estimating using Significant Figures

Significant Figures can be used to estimate an answer to any calculation.

Examples :-

Round each number to **1 significant figure** and estimate :-

1. $6587 + 2189$

$$\Rightarrow 7000 + 2000 \\ = 9000$$

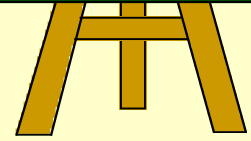
2. 372×197

$$\Rightarrow 400 \times 200 \\ = 80000$$

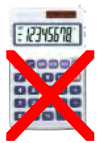
3. $5381 \div 46$

$$\Rightarrow 5000 \div 50 \\ = 100.$$

Be able to estimate an answer using significant figures



Exercise 3



1. Round each number to **1 significant figure** to estimate each calculation :-

a $4531 + 1771$

b $87\,542 - 14\,876$

c $131\,871 + 72\,114$

d $33\,155 - 11\,517$

e 136×54

f 346×173

g 1175×457

h 542×777

i $419 \div 14$

j $1873 \div 223$

k $111\,554 \div 1881$

l $22\,761 \div 449$.

2. Round each number to **2 significant figures** to estimate each calculation :-

a $7956 + 1453$

b $62\,275 - 11\,615$

c 1788×196

d $10\,123 \times 119$

e $89\,514 \div 297$

f $237\,123 \div 997$.

3. Round each number to **1 significant figure** to estimate each calculation :-

a $395 + 115 \times 19$

b $315 \times 581 - 29\,745$

c $1960 \div 41 + 172$

d $1.23 + 1.9 \times 3.7$

e $19.4 - 2.95 \times 6.199$

f $23.3 \div 11.98 + 29.13$.

4. Round each number to **1 significant figure** to estimate each calculation :-

a In an orchard, one hundred and ninety two apples are put into each barrel.
How many apples are there in 53 barrels ?

b There are 9156 pages in 327 identical magazines.
How many pages are in each magazine ?

5. Use a calculator to find the exact answers to questions 1-4.
Compare each answer to your estimate.





1. Round each of the following to **1 decimal place** :-
a 15.64 b 0.777.
2. Round each of the following to **2 decimal places** :-
a 1.3209 b 0.9951.
3. Round each of the following to **3 decimal places** :-
a 4.2097 b 0.0655.
4. Round each of the following to **1 significant figure** :-
a 2496 b 357 600.
5. Round each of the following to **2 significant figures** :-
a 0.0597 b 3 239 980.
6. Round each of the following to **3 significant figures** :-
a 55487 b 0.004638.
7. How many significant figures have each of the following numbers been rounded to ?
a 0.2004 b 0.050 c 15005.
8. For each calculation below :-
(i) Round each number to **one significant figure**.
(ii) Give an **approximate** answer to each calculation.
a 319×47 b 1809×278 c 0.384×212
d $7809 \div 23$ e $917\,200 \div 2684$ f $0.5832 \div 1.74$.
9. The number of votes cast during the General Election in Strathdury was **36 698**.
Round this to :-
a **2 significant figures** b **1 significant figure**.
10. Rounded to **2 significant figures**, the number of bees in a hive was **4700**.
What was the **greatest** number of bees there could have been in the hive ?

11.  A lorry made 18 trips to remove 379 350 kg of rubble from a building site.
Approximately, what weight of rubble was removed on each trip ?
12. a To estimate the answer to $899\,300 \times 257$, Amy uses $900\,000 \times 300$.
Will Amy's estimate be on the high side or the low side ? **Explain**.
b To estimate the answer to $899\,300 \div 257$, Amy uses $900\,000 \div 300$.
Will Amy's estimate be on the high side or the low side ? **Explain**.




CHAPTER 2

Whole Numbers

Addition, Subtraction, Multiplication & Division

Be able to solve problems using mathematical operations

In the following exercise you will have to carefully read each problem and decide whether to use $+$, $-$, $\times$ or $\div$ to solve it.

Examples :-

Jason earns £20563 per year. Jan gets an annual salary of £24168.

1. What is their combined pay ?

This is a $+$ problem.

$$\begin{array}{r} \text{£}20563 \\ + \text{£}24168 \\ \hline \text{£}44731 \end{array} \quad \begin{array}{l} \text{Combined pay} \\ \text{is } \text{£}44731. \end{array}$$

2. How much **more** than Jason does Jan earn ?

This is a $-$ problem.



$$\begin{array}{r} \text{£}24168 \\ - \text{£}20563 \\ \hline \text{£}3605 \end{array} \quad \begin{array}{l} \text{Jan earns } \text{£}3605 \\ \text{more than Jason.} \end{array}$$

3. What would Jason earn over 3 years at this rate of pay ?

This is a $\times$ problem.

$$\begin{array}{r} \text{£}20563 \\ \times 3 \\ \hline \text{£}61689 \end{array} \quad \begin{array}{l} \text{Jason would} \\ \text{earn } \text{£}61689. \end{array}$$

4. What did Jan earn in the first three months ?

This is a $\div$ problem.

$$\begin{array}{r} \text{£}6042 \\ 4 \overline{) \text{£}24168} \end{array} \quad \begin{array}{l} \text{Jan earns } \text{£}6042 \\ \text{every 3 months.} \end{array}$$

$\div 4$, as there are 4 lots of 3 months in a year.

Exercise 1

Decide whether to **ADD**, **SUBTRACT**, **MULTIPLY** or **DIVIDE** then solve the problem.



1. As a bus arrived at a stop, there were 38 people on board.
At the stop, a further 17 passengers got on.
How many were there now on the bus ?



2.  On January 1st 2011, I noted that my car had done 28 312 miles.
On January 1st 2012, the reading on the odometer was 41 187.
How many miles had my car covered over the year ?

3. A palette holds 1275 pots of noodles.
How many pots are there altogether
in 6 palettes ?



4.  A week consists of 7 days.
How many weeks are there in 805 days ?

5. Find the answer to $5 \times 568 \div 8$.

6. Arthur bought a brand new car for £8998.
One year later, it was valued at only £7005.
How much had the value of his car dropped over the year ?



7.  A train travelled for 6 hours at an average speed of 235 km/hr.
How many kilometres had the train travelled ?

8. Sultana shortcakes are packed into jars of 8.
Every day, the biscuit factory hopes to make 6840 sultana shortcakes.
How many jars will be needed each day ?



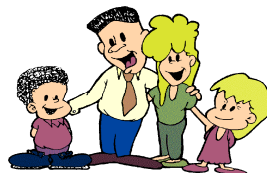
9.  During a storm, a plane dropped in height from 35280 feet to 29690 feet.
By how many feet had it dropped ?

10. An hour consists of $(60 \times 60) = 3600$ seconds.
How many seconds are there in 3 hours ?



11.  Jessie works in a hat shop for 4 hours per day.
She worked a total of 592 hours over the past year.
How many days did she turn up for work ?

12. Mr & Mrs Greig took their two children to Playdome for a day out.
a How much was it for 2 adult and 2 children's tickets ?
b They bought the Family Ticket.
How much did they save ?



PLAYDOME (daily ticket) (unlimited rides)	
Adult	£9.75
Child	£5.99
Family (2 adults + 2 kids)	£25.75



You may use a calculator from Question 12 onwards

13.  The total bill for 8 ladies who went on a golfing weekend including accommodation and two rounds of golf, came to £2158.
How much did each lady pay if the bill was shared evenly ?

14. It costs £7.95 for an adult and £4.80 for a child to go to the cinema in London.
How much did it cost for a party consisting of 4 adults and 5 children to go watch a film while they were in London ?



15. Alfredo's sell boxes of mini pizzas.
A box of 6 costs £16.50 and a box of 4 costs £11.40.
Which is the better deal ? Explain your answer with working.



16. Copy and complete this bill for vegetables bought to make home-made soup.



3 kg carrots at £0.62 / kg
5 kg leeks at £0.84 / kg
 $\frac{1}{2}$ a cucumber (price for 1 - £1.18)

Total £ _____

17. Tracy bought a pack of 12 bottles of carpet shampoo on the internet for £57.60 + post and package of £5.60.



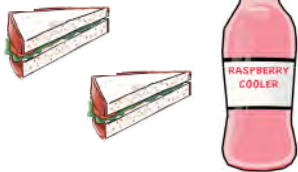
She saw the same shampoo in the supermarket at £5.95 per bottle.

How much did Tracy save by ordering online ?

18. Ewan bought 2 bikes at a car boot sale for a total of £48.50. He sold the better one for £39.75, but only got £15 for the rusty one. He still made a profit though, - how much ?



19. Two packs of sandwiches and a bottle of Raspberry Cooler cost £7.36. If the bottle cost 80p, what was the price of a pack of sandwiches ?



20. Brian took his parents and in-laws for afternoon tea to Glenhaws Hotel. They ordered 5 slices of apple pie, 3 coffees and 2 teas. The total bill came to £22.80.

If the pie slices were £2.75 each and the teas £1.60 each, what must the cost of a coffee have been ?



21. Nine friends went for a meal. If the total bill had been shared amongst all of them, each would have had to pay £32.88. As Clive had turned up with no money, the others had to split the bill between the 8 of them. How much did they each have to pay ?



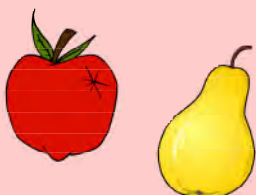
22. Mrs Able bought a new washing machine by paying a deposit of £23.95, followed by 9 monthly payments of £22.25. What was the the total cost of the washing machine ?



23. 2 adult tickets and 6 child tickets for a train journey comes to exactly the same as that for 3 adults and 2 children. If an adult ticket is £5.20, calculate the cost of a child's ticket.



24. John bought 10 pieces of fruit, a mixture of apples and pears. Each apple cost 45p and each pear cost 60p. If his bill came to £4.95, how many of each must he have bought ? (Hint - make a guess first, check how far out your answer is and re-guess).



Add, Subtract, Multiply & Divide Mentally

Be able to use quick methods to carry out mental calculations

Mental methods are about trying to get the **correct answer** in the **quickest** and **easiest** way. We will look at addition and subtraction first.

Example 1 :-

Addition

$$26 + 39$$

(Treat as $26 + 40$ and take 1)

$$= 26 + 40 - 1$$

$$= 66 - 1$$

$$= 65$$

Example 2 :-

Subtraction

$$83 - 49$$

(Treat as $83 - 50$ and add 1)

$$= 83 - 50 + 1$$

$$= 33 + 1$$

$$= 34$$

Example 3 :-

Addition

$$57 + 24$$

(Do $50 + 20$ add $7 + 4$)

$$= 70 + 11$$

$$= 81$$

Example 4 :-

Subtraction

$$85 - 42$$

(Do $80 - 40$ add $5 - 2$)

$$= 45 - 2$$

$$= 43$$

YOU have to choose the quickest and easiest method.

Discuss various methods in class.

Exercise 2



1. Write down the easiest, quickest way to calculate **mentally** :-

a $39 + 46$

"add + 46, then take"

b $90 - 68$

"90 -, then take"

c $390 + 240$

"add + 240, then take"

d $87 - 34$

"80 -, then add 7 -"

e $2300 + 4500$ "add, then add"

f $520 - 280$ "520 -, then add"

2. Choose your own mental method to find the answers to these :- (You might like to time yourself).

a $39 + 58$

b $53 + 66$

c $19 + 85$

d $38 + 88$

e $70 - 25$

f $69 - 53$

g $100 - 72$

h $70 - 39$

i $350 + 190$

j $690 + 220$

k $160 + 420$

l $320 + 990$

m $750 - 330$

n $790 - 460$

o $700 - 140$

p $1000 - 280$

q $410 - 390$

r $820 - 380$

s $460 - 190$

t $810 - 670$

u $2300 + 4500$

v $2900 + 5800$

w $6800 - 2300$

x $9000 - 6900$.

3. Do these problems **mentally** :-

- a** There were 69 people in a queue outside a night club.
As the doors were about to open, 24 more people arrived.

How many were now in the queue ?



b



Of the 670 pupils in a primary school, 360 are girls.

How many boys are in the school ?

- c** Dave has exactly £1000 in his bank.

If he buys a laptop, priced £399 with this money,
how much will be left in the bank ?



Mental Multiplication and Division methods are slightly more complicated.

Example 1 :-

Multiplication

$$\begin{aligned} & 37 \times 3 \\ & \text{(Treat as } 3 \times 30 \text{ and add } 3 \times 7) \\ & = 3 \times 30 + 3 \times 7 \\ & = 90 + 21 \\ & = 111 \end{aligned}$$

Example 3 :-

Division

$$\begin{aligned} & 48 \div 3 \\ & \text{(Split } 48 \text{ into } 30 \text{ and } 18 \text{ as they} \\ & \text{both can be } \div 3 \text{ easily, and add)} \\ & = 30 \div 3 + 18 \div 3 \\ & = 10 + 6 \\ & = 16 \end{aligned}$$

Example 2 :-

Multiplication

$$\begin{aligned} & 4 \times \text{£}1.99 \\ & \text{(Treat as } 4 \times \text{£}2 \text{ and take } 4 \times 1\text{p}) \\ & = 4 \times \text{£}2 - 4 \times 1\text{p} \\ & = \text{£}8 - 4\text{p} \\ & = \text{£}7.96 \end{aligned}$$

Example 4 :-

Division

$$\begin{aligned} & 228 \div 6 \\ & \text{(Split } 6 \text{ into } 2 \times 3 \text{ and do} \\ & 228 \div 2 \div 3) \\ & = 228 \div 2 \div 3 \\ & = 114 \div 3 \\ & = 38 \quad \text{Not all that easy!} \end{aligned}$$

** Using mental methods is about choosing the method that works best for you and the numbers you are dealing with.*

4. Write down the easiest, quickest way to calculate **mentally** :-

- | | | | | | |
|---|-------------------------|------------------------------------|---|-------------------------|------------------------------------|
| a | 83×9 | "9 x ..., add 9 x ..." | b | $\text{£}5.99 \times 3$ | "3 x £..., then take 3 x ... p" |
| c | $\text{£}1.97 \times 5$ | "5 x £..., then take 5 x ... p" | d | $42 \div 3$ | "Split 42 into 30 & 12, then" |
| e | $65 \div 5$ | "Split 65 into 50 & 15, then" | f | $174 \div 6$ | "174 ÷ ÷ = ..." |

5. Choose your own easiest, quickest way to find the answers to the following **mentally** :-

- | | | | | | | | |
|---|-------------------------|---|-------------------------|---|-------------------------|---|-------------------------|
| a | 26×2 | b | 46×3 | c | 81×5 | d | 104×7 |
| e | $3 \times \text{£}1.99$ | f | $7 \times \text{£}3.99$ | g | $4 \times \text{£}2.96$ | h | $9 \times \text{£}6.20$ |
| i | $54 \div 3$ | j | $126 \div 2$ | k | $136 \div 4$ | l | $72 \div 6$ |
| m | $126 \div 6$ | n | $108 \div 4$ | o | $152 \div 8$ | p | $126 \div 9$ |

6. Do these problems **mentally** :-

- a The owner of the Glenmore Hotel went into town to buy three HD Ready TV's, priced £999 each.

What did his bill come to ?



b



Bonnie counted out 144 jelly beans from a jar and shared them with two of her friends.

How many did they get each ?

Multiplication/Division by Multiples of 10, 100 & 1000

Be able to multiply/divide by 30, 400, 2000 etc.

Multiplying a number by 30, 400, 2000, etc. is done using **two steps** :-

Step 1 => multiply by the 3, 4, 2 etc. first.

Step 2 => then multiply by the 10, 100 or 1000.

Example 1 :-

$$348 \times 30$$

Step 1 Find 348×3

$$\begin{array}{r} 348 \\ \times 3 \\ \hline 1044 \end{array}$$

Step 2 Now do $1044 \times 10 = 10440$

Example 2 :-

$$419 \times 2000$$

Step 1 Find 419×2

$$\begin{array}{r} 419 \\ \times 2 \\ \hline 838 \end{array}$$

Step 2 Now do $838 \times 1000 = 838000$

Dividing by 30, 400 or 2000 is also done using **two steps** :-

Step 1 => divide by the 10, 100 or 1000 first.

Step 2 => then divide by the 3, 4, 2 etc.

Example 3 :-

$$5430 \div 30$$

Step 1 Find $5430 \div 10 = 543$

Step 2 Now do $543 \div 3 = 181$

$$\begin{array}{r} 181 \\ 3 \overline{) 543} \end{array}$$

Example 4 :-

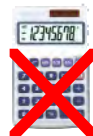
$$312000 \div 400$$

Step 1 Find $312000 \div 100 = 3120$

Step 2 Now do $3120 \div 4 = 780$

$$\begin{array}{r} 780 \\ 4 \overline{) 3120} \end{array}$$

Exercise 3



1. Do the following **mentally** :- (use the 2-step approach)

a 12×30

b 41×40

c 20×80

d 55×60

e 20×114

f 31×900

g 600×52

h 2000×36

i 120×4000

j $80 \div 20$

k $720 \div 30$

l $2000 \div 500$

m $49700 \div 700$

n $6000 \div 2000$

o $540000 \div 9000$

2. Calculate each of the following (not necessarily mentally) :-

a 185×30

[Find 185×3 first = 555 and then find 555×10]

b 427×50

c 309×40

d 519×80

e 112×90

f 2198×20

g 2365×30

h $630 \div 30$

[Find $630 \div 10$ first = 63 and then find $63 \div 3$]

i $1080 \div 40$

j $950 \div 50$

k $540 \div 60$

l $3780 \div 70$

m $46240 \div 80$

n $15480 \div 90$

3. Work out these, using the 2 step method :-

- | | | |
|---|---------------------|---|
| a | 204×200 | [Find 204×2 first = 408 and then find 408×100] |
| b | 539×300 | c 246×500 |
| e | 307×2000 | f 457×4000 |
| h | $6300 \div 300$ | [Find $6300 \div 100$ first = 63 and then find $63 \div 3$] |
| i | $7200 \div 400$ | j $90\,500 \div 500$ |
| l | $84\,000 \div 2000$ | m $882\,000 \div 6000$ |
| | | n $1\,976\,000 \div 8000$. |

There is a quick way of doing some multiplications and divisions **mentally**.

Example 1 :- $70\,000 \times 6000$. Simply do 7×6 (= 42) and add on the 7 zeros ... **420 000 000**

Example 2 :- $120\,000 \div 3000$. Cancel out an equal number of zeros $120\,000 \div 3000$ and then do the simple division $120 \div 3 = 40$.

4. Do the following **mentally** :-

- | | | | | | |
|---|--------------------|---|-------------------------|---|----------------------------|
| a | 70×40 | b | 900×60 | c | $1400 \div 20$ |
| d | $2800 \div 40$ | e | 500×400 | f | 60×7000 |
| g | $18\,000 \div 600$ | h | $150\,000 \div 300$ | i | 4000×700 |
| j | 5000×2000 | k | $400\,000 \div 2000$ | l | $7\,200\,000 \div 800$ |
| m | 9000×8000 | n | $4\,340\,000 \div 7000$ | o | $17\,800\,000 \div 4000$. |

5. Solve these problems **mentally** :-

- a 50 railway workers won £60 000 each playing the lottery.
What must their total winnings have come to ?



- b  30 squirrels equally shared 1680 nuts which had fallen from trees in an orchard.
How many nuts did each squirrel get ?

- c There are 3600 seconds in an hour.
How many seconds are there in 25 days (600 hours) ?



- d  A garden nursery brings on 7 500 000 young plants which are later distributed equally amongst 500 garden centres.
How many plants are sent to each garden centre ?

- e A football club has 30 players, each valued at £2.5 million.
(i) Write down what £2.5 million is in figures.
(ii) What is the total value of the players to the club ?
Their stadium when full holds 75 000 people, each paying £40 for a match ticket.
(iii) How much money does the club take in on a match day with a full stadium ?



BOMDAS - the Order of Operations

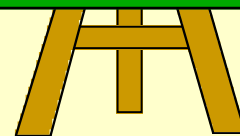
You discovered in Book 2b that many calculations have to be completed in a specific order. We now go over this point in further detail.

Example :- For $100 - 20 \times 4$ the answer is **NOT** $80 \times 4 = 320$.

The answer **IS** $100 - 80 = 20$.

The easy way to remember which part of a calculation comes first is using the mnemonic **BOMDAS**.

Be able to
+, -, ×, ÷
using the order
of operations



Example 1 :-

$$21 + 9 \times 4$$

Multiply first

$$= 21 + 36$$

$$= 57$$

Example 2 :-

one third of $90 - 30$

Of first

$$= 30 - 30$$

$$= 0$$

Example 3 :-

$$(27 + 33) \div (2 \times 15)$$

Brackets first

$$= 60 \div 30$$

$$= 2$$

- Multiply & Divide rank equally
- Add & Subtract rank equally

1	2	3	4
B	O	M or D	A or S

- After you have applied **B** and **O**, go from left to right using any **M** or **D** as you find them.
- Then go from left to right doing any **A** or **S** as you find them.

Exercise 4

1. Use **BOMDAS** to help you calculate :-

a $25 + 8 \times 3$

b $50 - 4 \times 9$

c $20 \times 2 + 10$

d $49 - 28 \div 7$

e $100 - 50 \div 10$

f $74 - 48 \div 2$

2. Calculate :-

a $50 - 24 + 4 - 10$

b third of $60 \div 5$

c quarter of $40 - 8$

d $\frac{1}{2}$ of $72 \div 9$

e $2 + \frac{1}{4}$ of 48

f $8 - \frac{1}{3}$ of $21 + 5$

g $9 \times 6 - 100 \div 4 + 1$

h $7 \times 8 - 5 \times 9 + 28 \div 7$

i $8 - \frac{1}{5}$ of $(44 - 9)$.

3. Find, showing two more steps each time :-

a $24 + (18 \div 3)$

b $75 \div (18 - 13)$

c $9 \times (8 + 12)$

d $300 \div (106 + 44)$

e $8 \times (9 + 4) - 104$

f $(7 + 3) \times (9 - 1) - 78$.

4. Copy each of the following and **insert brackets** to make each calculation correct :-

a $3 + 7 \times 2 = 20$

b $16 - 7 \times 2 = 2$

c $20 + 18 \div 2 = 19$

d $40 + 20 \div 4 \times 5 = 3$

e $15 + 30 \div 12 - 3 = 5$

f $5 + 8 \times 6 - 2 + 5 = 42$.

5. Find :-

a $200 \div 4 + 5 \times 10$

b a fifth of $(97 + 3)$

c $3 \times (68 + 12)$

d $9 \times 6 - 4$

e $4 + 8 \times 7$

f $7 + (9 \times 8)$

g $300 - \frac{1}{3}$ of 60×10

h $\frac{1}{10}$ of $(\frac{1}{5}$ of 150)

i $((12 \div 6) + 2) \times 6 - (17 + 3)$.



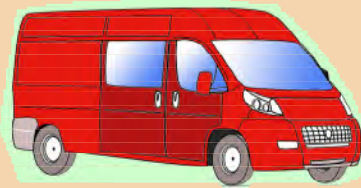
This is a non-calculator section.

1. Motherton United's home crowd for its last 4 matches are listed below.

Sat 4th Apr - 8794	Sat 18th Apr - 9105	Sat 2nd May - 27 095	Sat 16th May - 8205
--------------------	---------------------	----------------------	---------------------

- How many **more** spectators were there on the 18th April than on the 4th April ?
- What was the **total** attendance over the 4 games ?
- Which of the 4 matches do you think Motherton played in the cup ?

- 2.



Maximum weight 3 tonnes

An empty van weighs 2.35 tonnes (1 tonne = 1000 kg).

It is loaded with 20 parcels weighing 23 kg each and 10 sacks, each weighing 17 kg. The driver weighs 54 kg.

Is it safe for the driver to drive the van ? (Explain).

3. Davie bought 25 "gold" watches in Tokyo for €600.

He managed to sell 20 of them for €36 each,
The rest he got rid of in his **half price** sale.

How much **profit** did Davie make ?



- 4.



Mandy buys in 770 plastic balls and packs an equal number of them into 8 mesh containers like this, for sale.

How many plastic balls will be left over ?

5. Grandpa Jones, his daughter Lizzie and his two grandchildren go to the circus in town.

They can either pay the normal fare where Grandpa gets a concession ticket, or take up the **special offer**.

Which is the better deal and by how much ?

Billy Ball's Circus	
Adult	£22.75
Child	£15.50
Concession	£17.25
Family Special	£75.00
(2 adults & up to 3 kids)	

6. Calculate :-

- | | | |
|------------------|----------------------|---------------------|
| a 42×20 | b 215×3000 | c 307×400 |
| d $7500 \div 50$ | e $90\,000 \div 600$ | f $84\,700 \div 70$ |

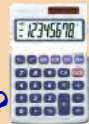
7. Carefully, work out the answers to the following :-

- | | | |
|---------------------|------------------------|---------------------------|
| a $12 - 2 \times 4$ | b $20 - 10 \div 5 + 3$ | c $20 \div (10 \times 2)$ |
|---------------------|------------------------|---------------------------|

8. Re-write the following and insert brackets to make each of the statements correct :-

- | | | |
|--------------------------|-----------------------|----------------------------|
| a $12 - 3 \times 2 = 18$ | b $16 \div 8 - 4 = 4$ | c $5 + 3 \times 9 - 8 = 8$ |
|--------------------------|-----------------------|----------------------------|

This is a calculator section.



9. a How many days were there altogether in the years 2005, 2006, 2007 and 2008 ?

- b I changed £400 to dollars before going to America .

The rate was £1 = \$1.66.

How many dollars did I receive ?

- c I have a number of 1p coins, twice as many 2p coins, three times as many 5p coins and four times as many 10p coins.

Altogether I have £6.00.

How many of each coin do I have ?



10.



I set "Boogie and the Monkeys" track - *You got my Attention*, to **repeat play** on my mp3 player.

It lasts two and a half minutes.

How many times will it play in a **whole day** ?

11. I bought a 50 inch flat screen HD TV set costing £599.

I paid it up monthly as follows :-

- an initial payment of £59.90 (10%),
- followed by 24 monthly payments of £27.50.

How much **less** would it have cost me if I'd paid cash ?



12.



A "**gross**" is an old unit of counting and equals a dozen dozen (or *twelve 12's*) = **144**.

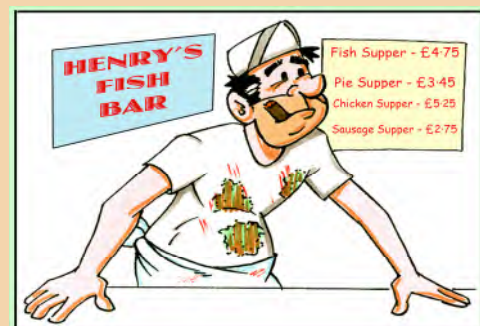
A farmer collected 5024 eggs from his chickens last week and packed them in cartons, each holding a gross.

- a How many **full** cartons did he get ?
b How many eggs was he left with ?

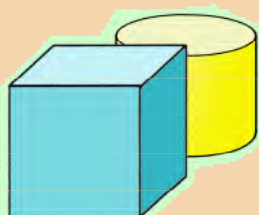
13. A group of 10 pupils, returning from an outing, bought some fish suppers and some pie suppers from Henry's.

The bill came to £43.60.

How many fish suppers and how many pie suppers must have been bought ?



14.



3 wooden cubes and 6 wooden cylinders weigh the same as 5 cubes and 2 cylinders ?

If a cube weighs 80 grams, what must a cylinder weigh ?

CHAPTER 3

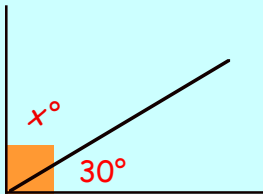
Angles

Complementary & Supplementary Angles

A 90° angle is called a **right angle**.

Any two angles that, when added together come to 90° , are called **Complementary Angles**.

Example :-



$$x + 30 = 90$$

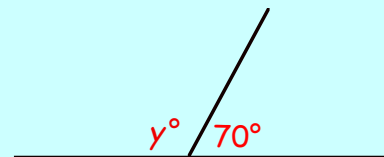
$$\text{so } x = 60$$

The **complement** of 30° is 60° .

A 180° angle is called a **straight angle**.

Any two (or more) angles that, when added together, make 180° , are called **Supplementary Angles**.

Example :-



$$y + 70 = 180$$

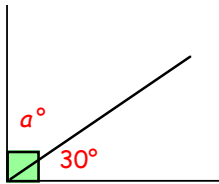
$$\text{so } y = 110$$

The **supplement** of 70° is 110° .

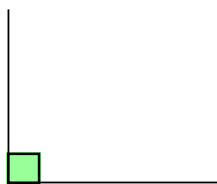
Exercise 1

1. Calculate the missing angle in each of the following :-

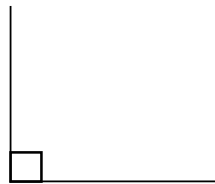
a



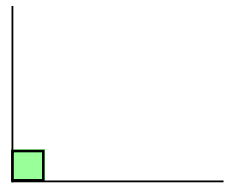
b



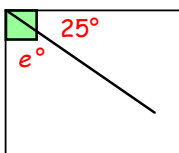
c



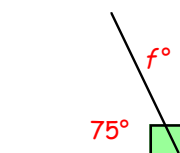
d



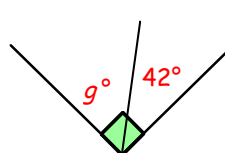
e



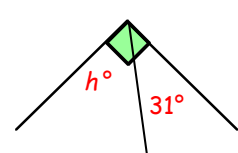
f



g



h



2. Write down the **complement** (complementary angle) of :-

a 60°

b 10°

c 88°

d 11°

e 19°

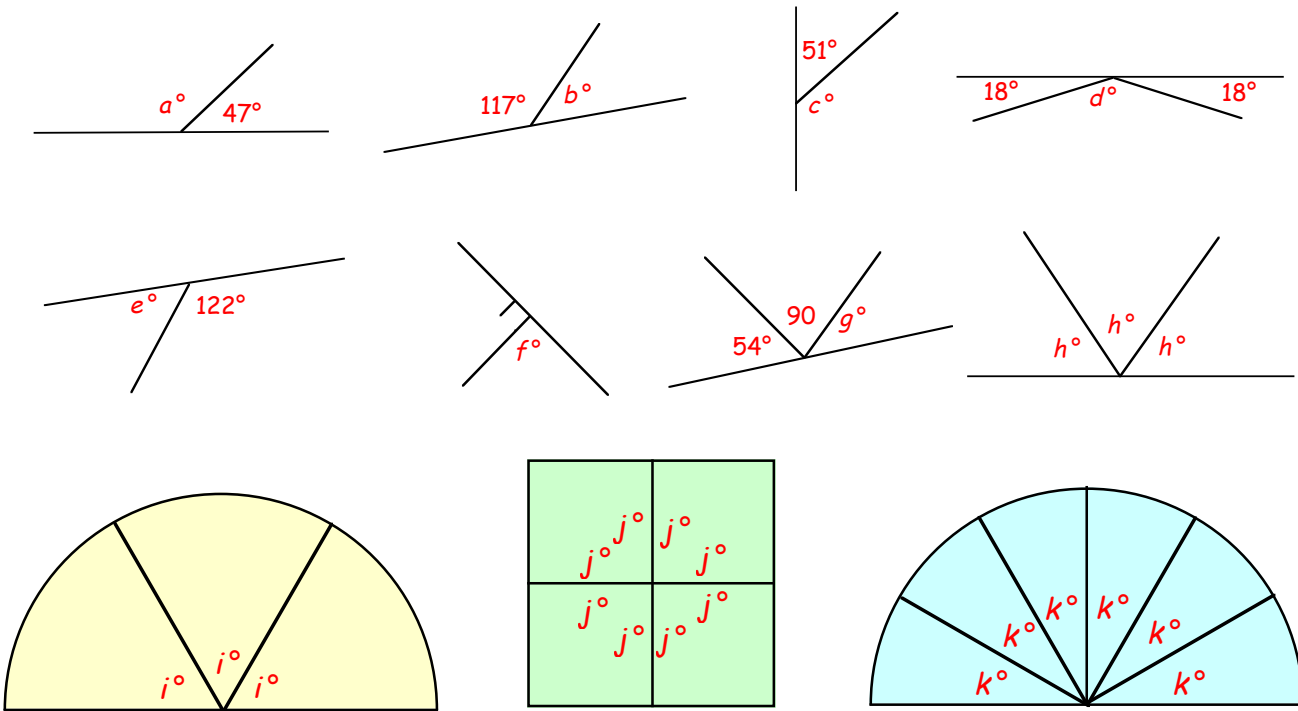
f 73°

g 8.5°

h 52.5°

3. What angle is its own **complement** ?

4. Calculate the missing angle in each of the following :-



5. Write down the **supplement** (supplementary angle) of :-

- | | | | | | | | |
|---|-------------|---|-------------|---|---------------|---|--------------|
| a | 100° | b | 25° | c | 137° | d | 176° |
| e | 1° | f | 111° | g | 179.5° | h | 87.5° |

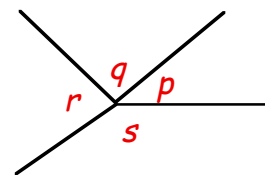
6. What angle is its own **supplement** ?

7. An angle is measured and found to be 83° .

- | | | | |
|---|---------------------------------|---|---------------------------------|
| a | What is its complement ? | b | What is its supplement ? |
|---|---------------------------------|---|---------------------------------|

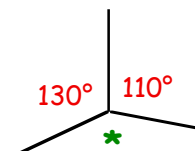
8. Shown are 4 angles which fit exactly around a point.

- a What answer will you get if you add all 4 angles ?
($p + q + r + s = ?$).
- b In general, what answer will you **ALWAYS** get when you add together all the angles round a point ?



9. a What do you get when you add $130^\circ + 110^\circ$?

- b Calculate the size of the 3rd angle (*).



10. a There are 3 angles round a point. One is 120° . A second is a right angle. Calculate the size of the third angle.

- b Four angles round a point are 37° , 111° , 104° and x° . Calculate the value of x .

Angles Round a Point

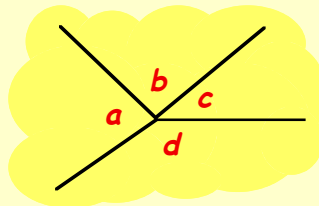
Be able to
calculate a missing
angle round
a point

The angles round a point must total 360° . (2 straight angles).

In the diagram shown

$$a + b + c + d = 360.$$

Examples :-

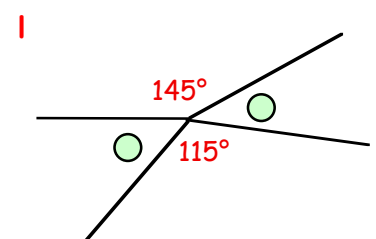
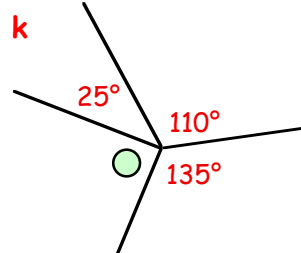
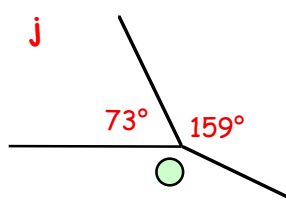
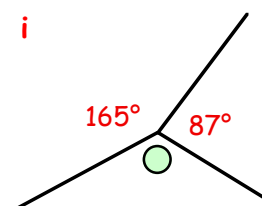
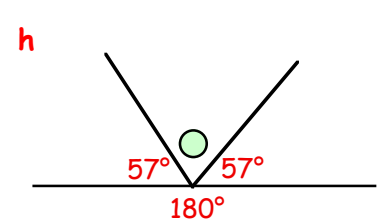
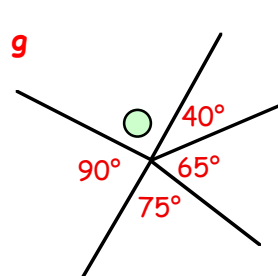
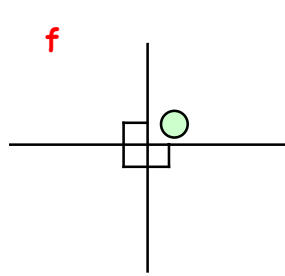
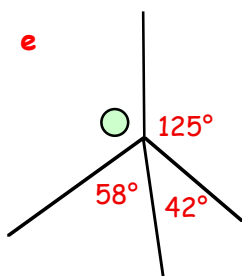
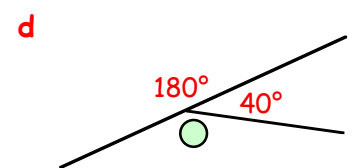
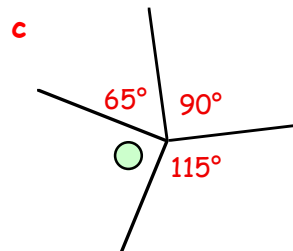
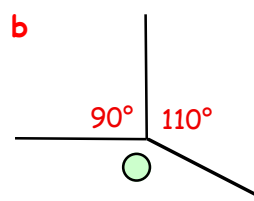
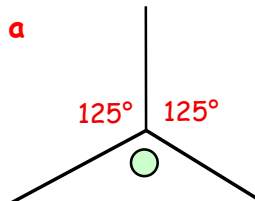


$$\begin{aligned} \text{Green circle} + 125 + 115 &= 360 \\ \Rightarrow \text{Green circle} + 240 &= 360 \\ \Rightarrow \text{Green circle} &= 120. \end{aligned}$$

$$\begin{aligned} \text{Yellow circle} + 120 + 90 + 65 &= 360 \\ \Rightarrow \text{Yellow circle} + 275 &= 360 \\ \Rightarrow \text{Yellow circle} &= 85. \end{aligned}$$

Exercise 2

1. Calculate the value of the angles marked $\bigcirc$:-



2. Sketch some diagrams similar to question 1.
Get your partner to find the missing angles.

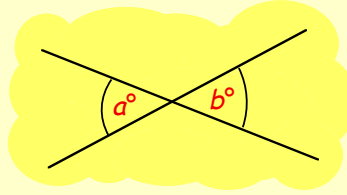
Vertically Opposite Angles

In the diagram shown, angles a and b must be the same.

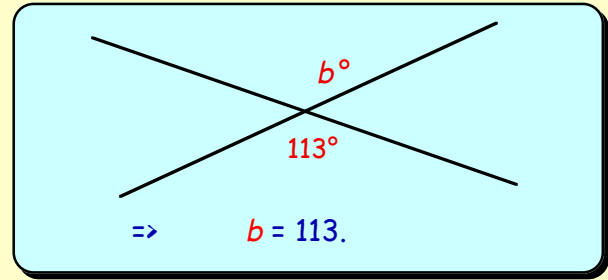
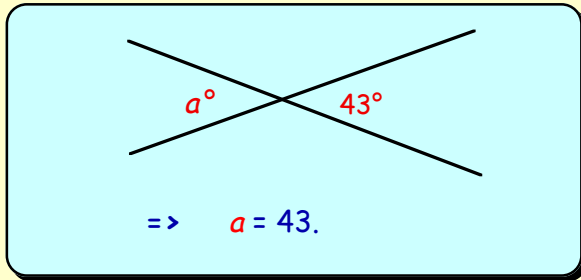
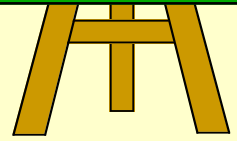
Discuss why $a = b$.

(*Hint* :- supplementary angles).

Examples :-



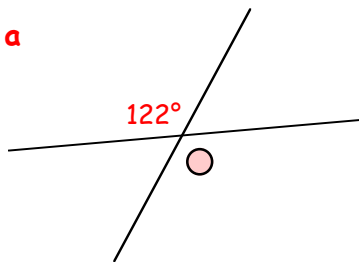
Be able to find missing angles using vertically opposite angles



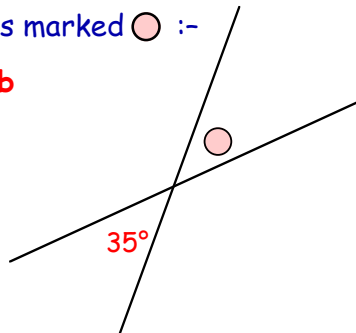
Exercise 3

1. Write down the value of the angles marked $\bigcirc$:-

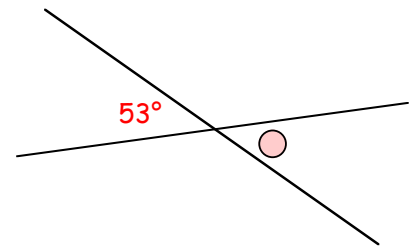
a



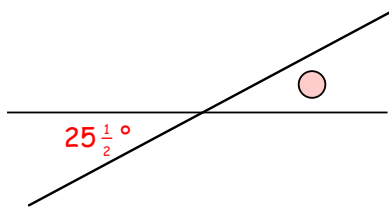
b



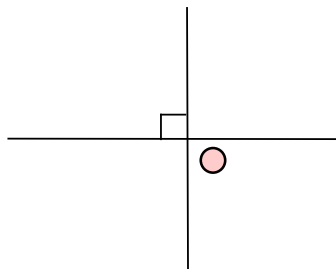
c



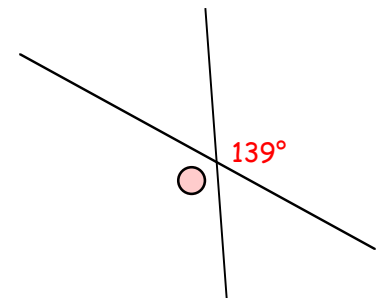
d



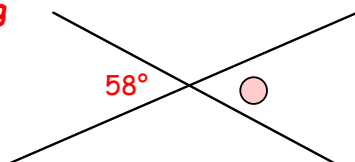
e



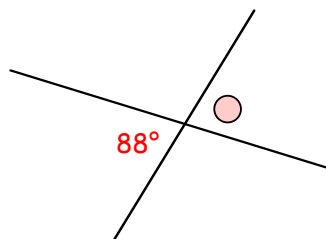
f



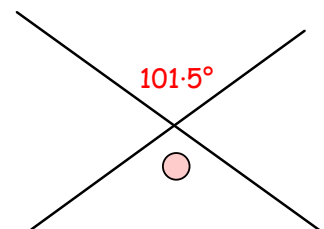
g



h



i



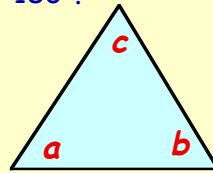
2. Sketch all the diagrams above and fill in **all** the missing angles.

3. Sketch some diagrams similar to question 1.
Get your partner to find the missing angles.

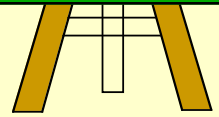
Angles in a Triangle

It is a well known fact in maths that no matter how big a triangle is, if you add all three angles together you always get 180° .

$$\Rightarrow a + b + c = 180$$



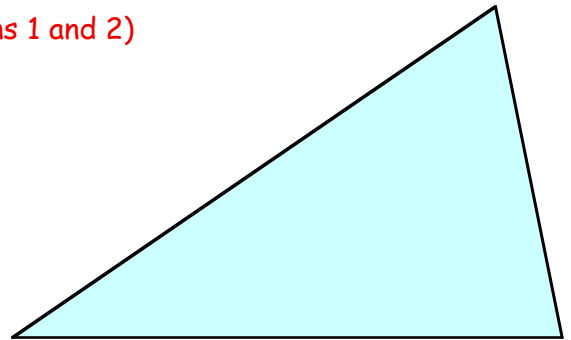
Be able to find a missing angle in a triangle



Exercise 4

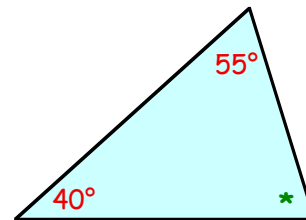
(You will need a protractor for questions 1 and 2)

1.
 - a Use a protractor to measure the three angles of this triangle.
 - b Add the three angles together.
 - c How close to 180° did you get?

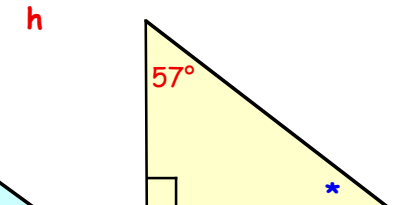
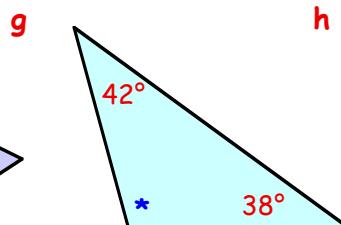
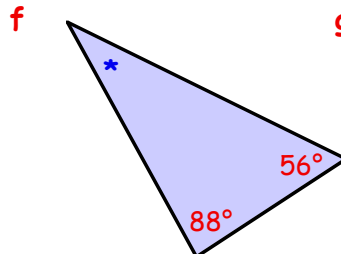
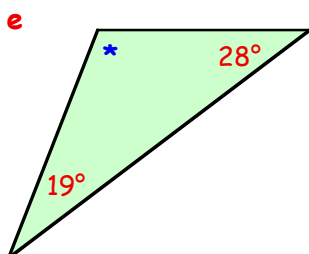
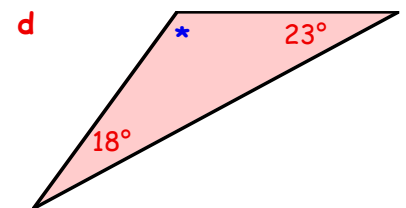
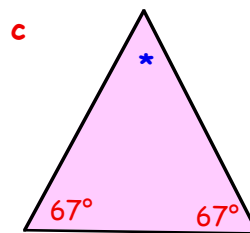
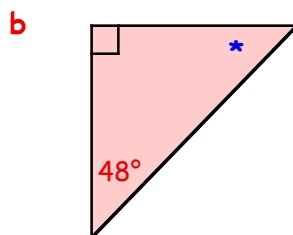
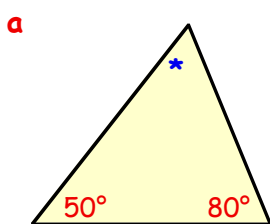


2.
 - a Draw a triangle of your own - any size, any shape. (make it about half the size of your page)
 - b Measure the 3 angles and check that the total comes to (about) 180° .

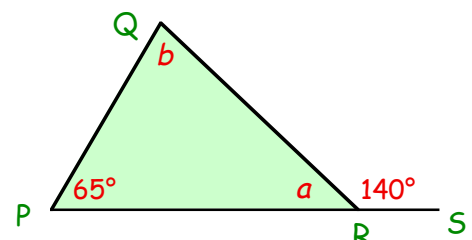
3.
 - a In this triangle, what is the value of $40^\circ + 55^\circ$?
 - b If all 3 angles add to 180° , what must the 3rd angle be (marked $*$)?



4. In each of these triangles, add the 2 given angles, then calculate the size of the 3rd angle.



5.
 - a Use the 140° to help you calculate the size of the angle marked **a**.
 - b Now use triangle **PQR** to help you find the value of **b**.

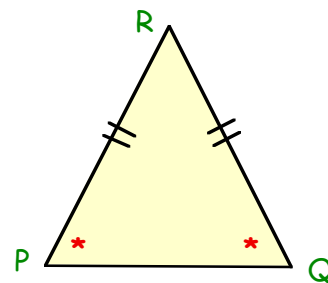


6. Can you remember the special name for this type of triangle ?

- The two sides (PR and QR) are equal.
- The two angles ($\angle RPQ$ and $\angle RQP$) are equal.

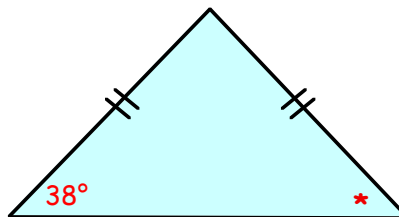
It is called an **ISOSCELES** triangle.

Look at the word, cover it up and learn to spell it.



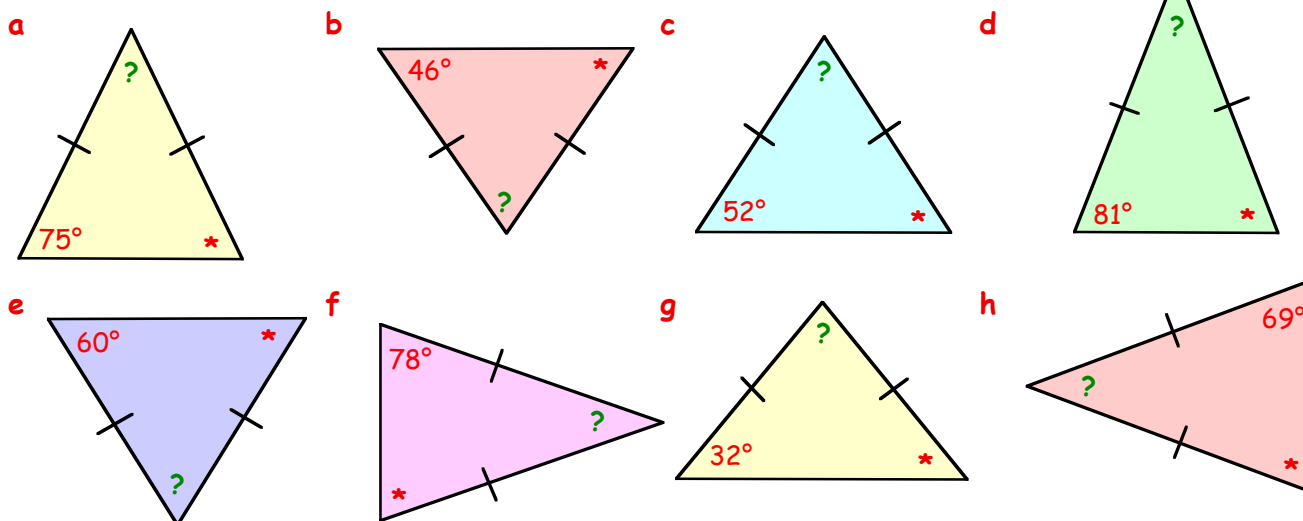
7. An **isosceles** triangle has 2 angles the same size.

- Write down the value of the angle marked *.
(don't measure it).
- Now calculate the size of the 3rd angle.



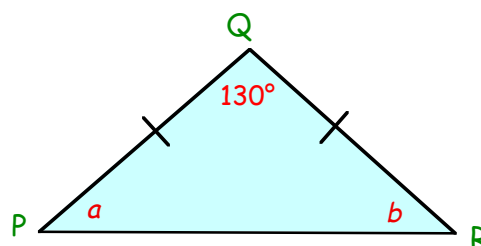
8. Make a small neat sketch of each of these isosceles triangles.

Calculate the sizes of the two missing angles in each triangle :-



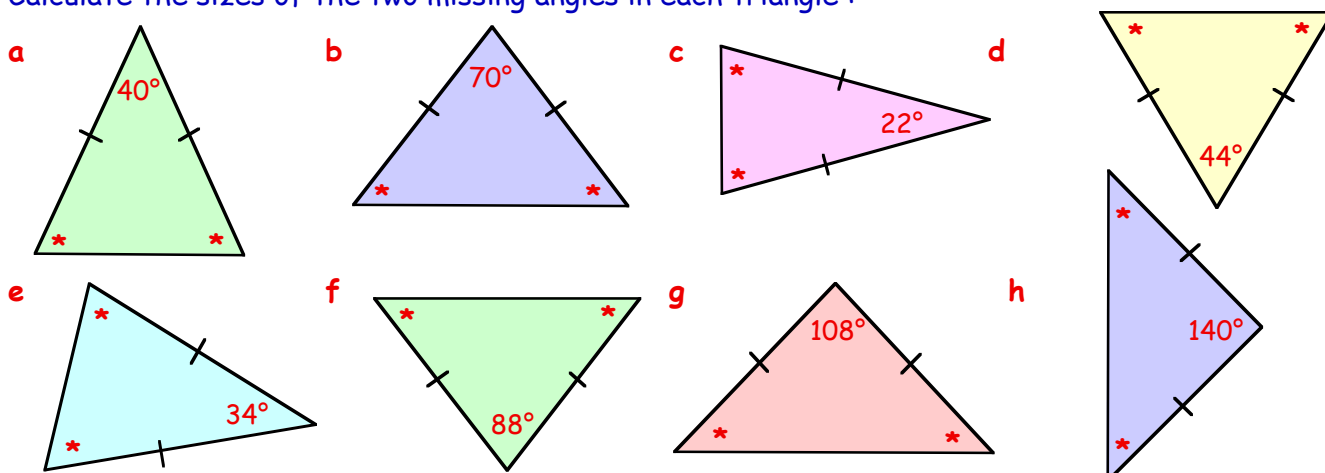
9. Triangle PQR is **isosceles**.

- If $\angle PQR = 130^\circ$, what is the value of $(a + b)$?
- Since a and b are both the same, what must both a and b be ?



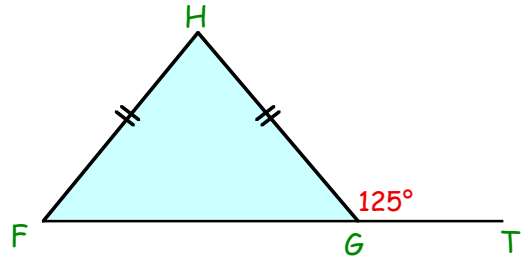
10. Make a neat rough sketch of each of these isosceles triangles.

Calculate the sizes of the two missing angles in each triangle :-



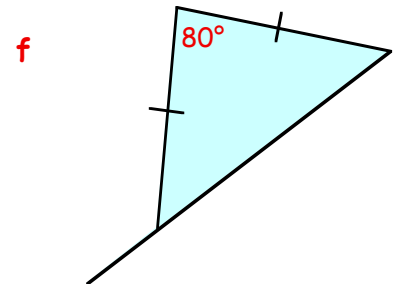
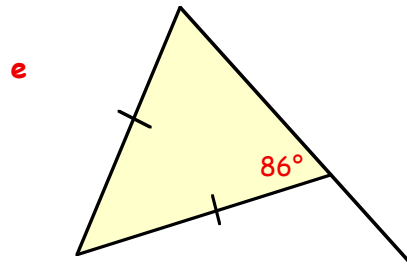
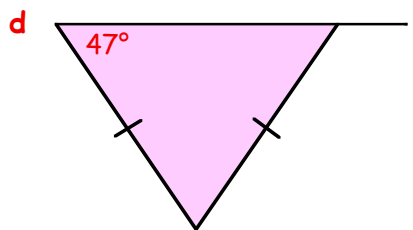
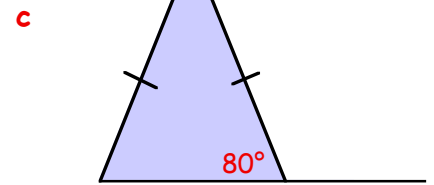
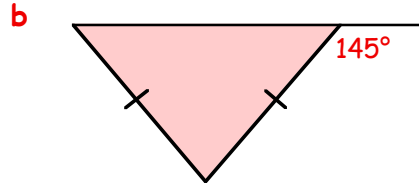
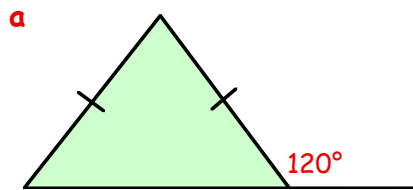
11. Triangle GFH is **isosceles**. $\angle HGT = 125^\circ$

- Calculate the size of $\angle HGF$.
- State the size of $\angle HFG$.
- Now calculate the size of $\angle GHF$.

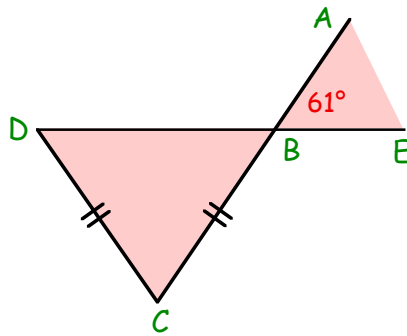


12. Copy each of the following.

Calculate and fill in the sizes of all the missing angles :-



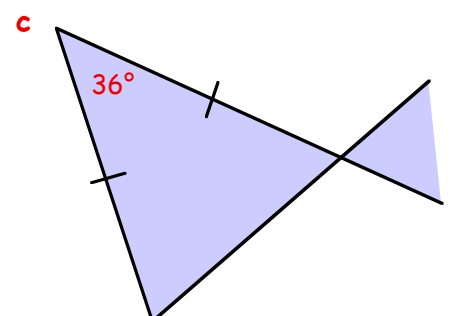
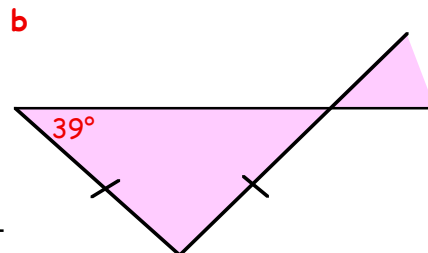
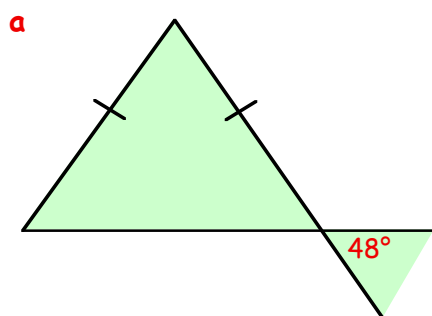
- 13.



Triangle BCD is **isosceles**. $BC = DC$. $\angle ABE = 61^\circ$

- State the size of $\angle DBC$.
- Write down the size of $\angle BDC$.
- Finally, what is the size of $\angle BCD$?

14. Copy the following figures and fill in all the missing angles.



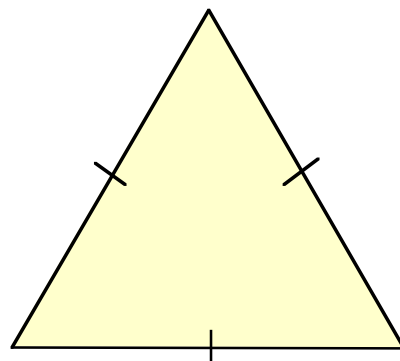
15. This is a very special triangle.

All 3 of its sides are the same length.

- What do we call this type of triangle?

All 3 angles are also the same size.

- Calculate the size of each of the 3 angles in this triangle.

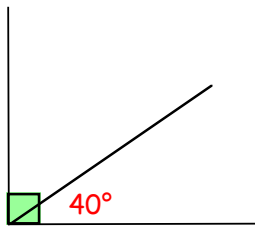


Exercise 5

Mixed Exercise

Copy and complete each diagram below filling in **all** missing angles :-

1. a



b



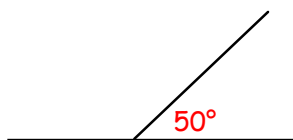
c



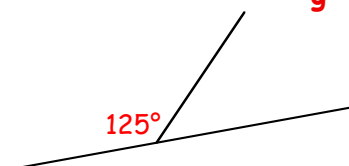
d



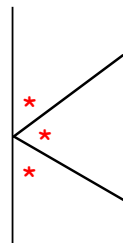
e



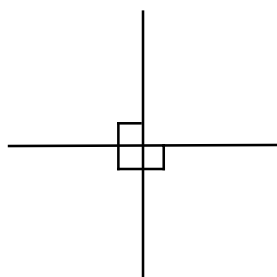
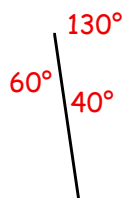
f



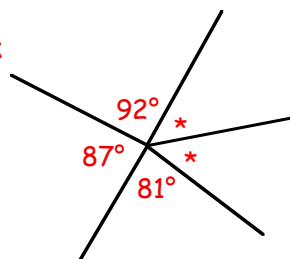
g



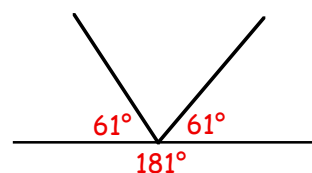
h



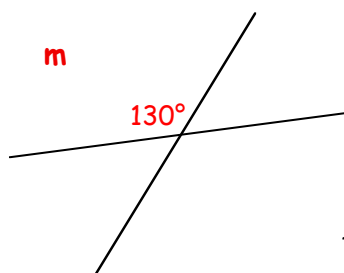
k



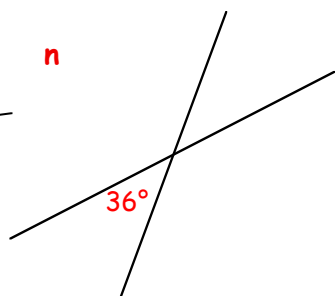
l



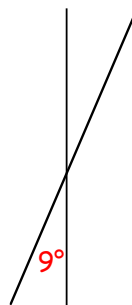
m



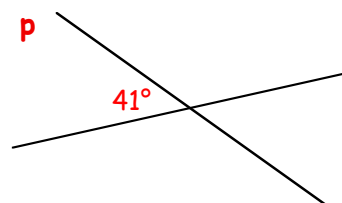
n



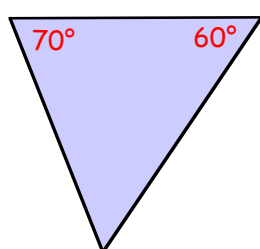
o



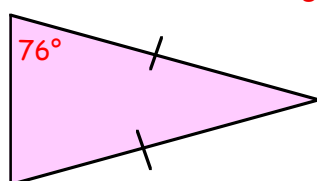
p



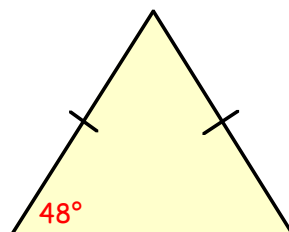
q



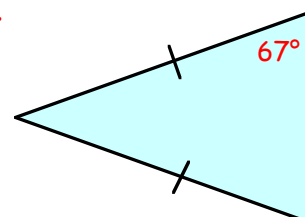
r



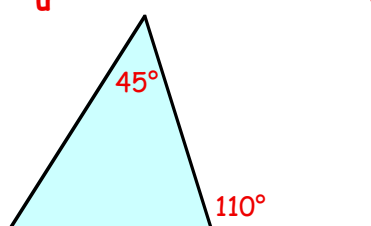
s



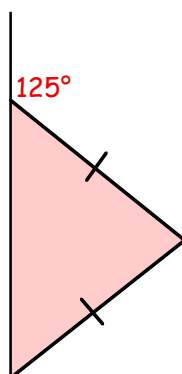
t



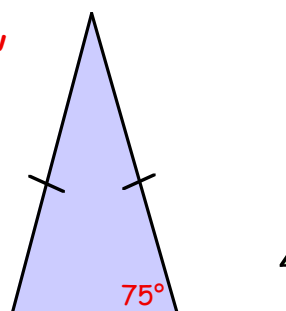
u



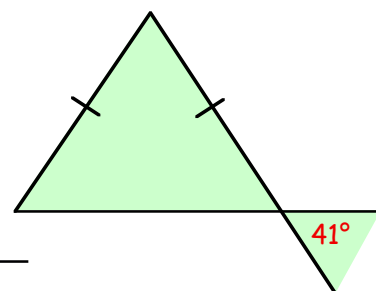
v



w

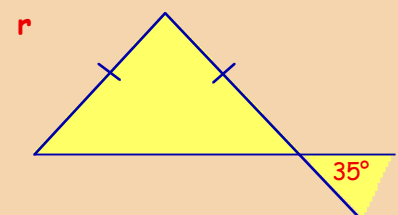
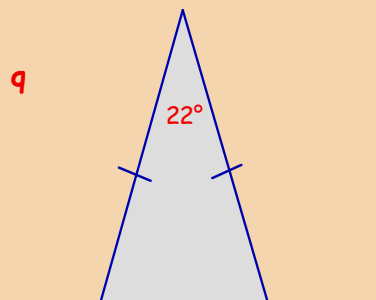
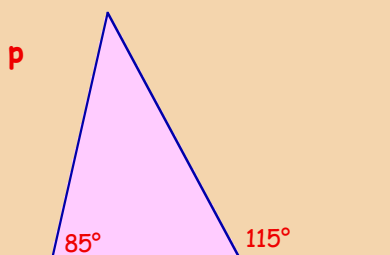
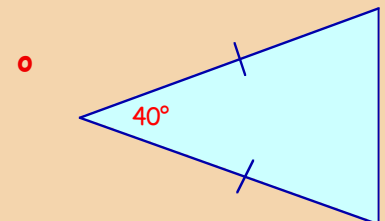
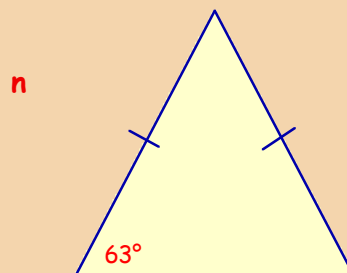
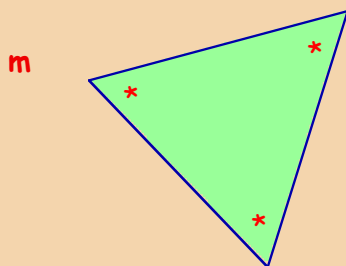
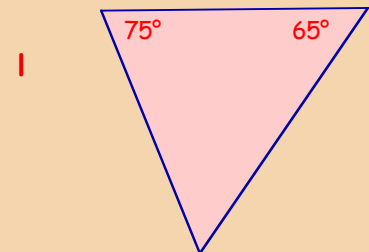
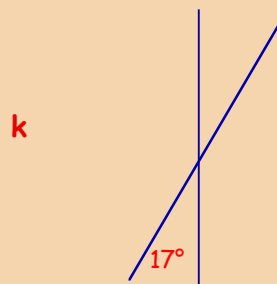
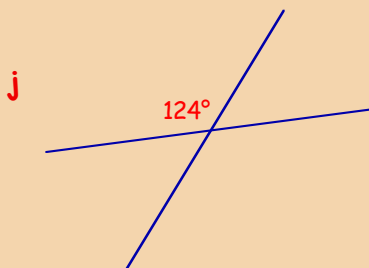
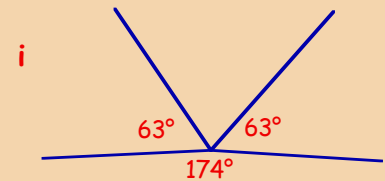
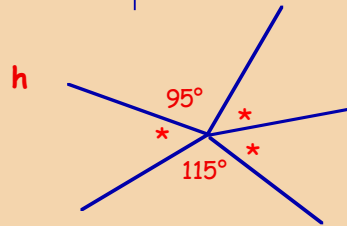
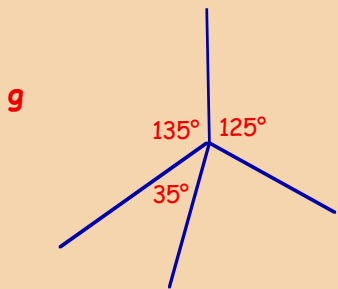
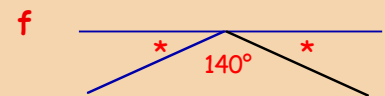
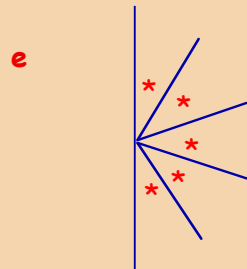
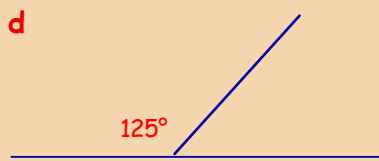
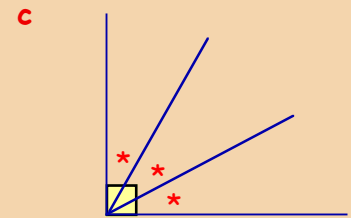
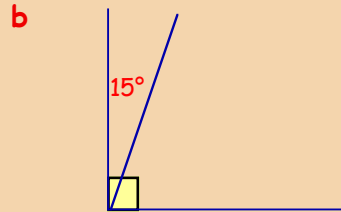
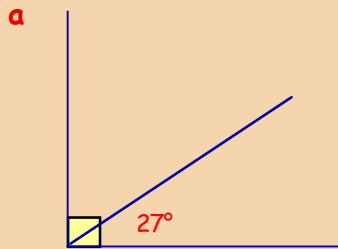


x





- What is the :-
 a complement of 40° b supplement of 40° ?
- Copy and complete each diagram below, filling in **all** missing angles :-



CHAPTER 4

Integers

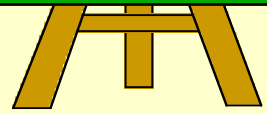
Negative Numbers in Context

The set of **Positive** and **Negative Whole** numbers, along with **Zero** are called the set of **Integers**.

Examples of Integers :- -8, -25, 17, 76, 0, -14, 4003, -3067.

* **Note** 2.5, $\frac{1}{3}$, $-5\frac{1}{4}$, -3.25, -213.8 etc. are **not** integers

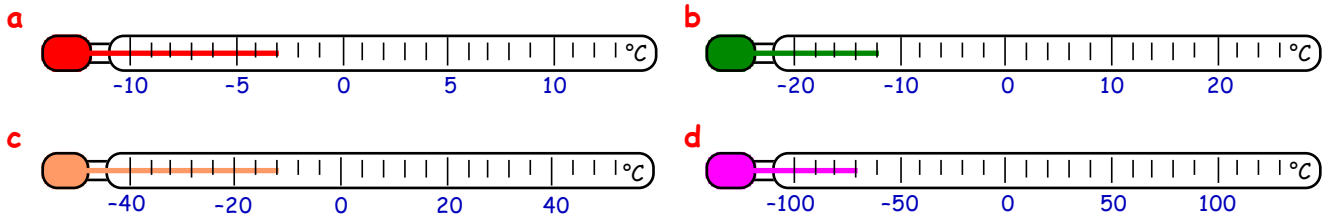
Working with
positive & negative
numbers and zero
in the real world



Exercise 1 Mainly Revision



1. What **temperatures** are shown on these thermometers ?



2. Banks deal with positive and negative values of **money**. (Discuss "in the **red**" and "in the **black**").

If Gerry has £100 in his bank account, the bank computer will show this as **£100.00**

Mary has **overdrawn** by £50. The computer will show this as **- £50.00**

a Sammi's account shows **£375.00**. What does this balance mean ?

b George's account shows **- £400.00**. What does this balance mean ?

c Henry had **£45.00** in his account, but withdrew £12.00.

What will his balance now show on the bank computer ?

d Brenda's balance last week was **-£20**, but she paid in £15.

What's her new balance and how much more will she need to pay in to clear her overdraft ?

e Len's bank balance showed **£70**.

He bought a lawnmower for £100 and a rake for £20, using his debit card.

How will his new balance show up on the bank computer ?



3. Negative numbers can be used in the context of **time**.

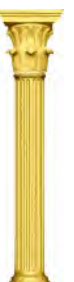
The London Olympics were held in the year 2012 A.D. (anno domini).

This means 2012 years since the birth of Christ. (or **+2012**).

If a man was born in the year **65 B.C.** (before Christ), we say he was born in the year (**- 65**).

a Use "+" or "-" signs to describe the following dates :-

- (i) 1966 A.D. (ii) 312 A.D. (iii) 21 B.C. (iv) 729 B.C.



3. b Bugatis Lavius was born in 100 B.C. and died in 44 B.C.

How old was Bugatis when he died ?

- c Augustus Caesar was born in 63 B.C. and died in 19 A.D.

What age was Augustus when he died ?

d



Minimus was born in 42 B.C. and lived to the age of 77.

In which year did Minimus die ?

e

Maximus died aged 63 in 54 A.D.

In which year was Maximus born ?

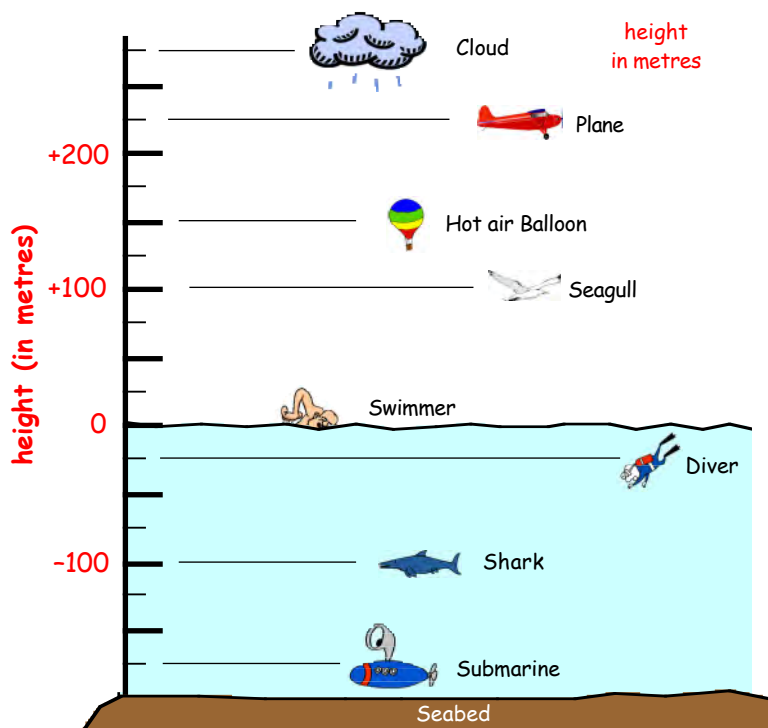


4. Positive and negative numbers are used to describe heights above or below sea-level.

Heights **above** sea level are **positive** (+).

Heights **below** sea level are **negative** (-).

- a Use "+" or "-" to describe the heights (depths) of the following :-



- (i) the seagull
- (ii) the shark
- (iii) the swimmer
- (iv) the hot air balloon
- (v) the seabed
- (vi) the plane
- (vii) the diver
- (viii) the submarine
- (ix) the cloud.

- b How far is :-

- (i) the seagull above the swimmer
- (ii) the diver below the swimmer
- (iii) the balloon above the seagull
- (iv) the submarine below the shark
- (v) the plane below the cloud
- (vi) the plane above the diver
- (vii) the shark below the seagull
- (viii) the seagull below the plane
- (ix) the cloud above the diver
- (x) the submarine below the cloud ?

5. We previously learned how helpful the drawing of a thermometer could be in carrying out integer calculations.

Copy the thermometer shown opposite into your jotter and use it to help you do the following :-

Find the temperature that is :-

- | | |
|------------------------------|-------------------------------|
| a 5°C up from 9°C | b 23°C up from 0°C |
| c 14°C up from 18°C | d 9°C down from 21°C |
| e 15°C down from 15°C | f 8°C up from -3°C |
| g 10°C down from -6°C | h 16°C up from -9°C |
| i 7°C down from 4°C | j 42°C down from 0°C |
| k 14°C down from -6°C | l 40°C down from -20°C |
| m 8°C up from -15°C | n 25°C up from -30°C. |

6. Look carefully at your thermometer.

Can you see that **2°C** is **8°C up** from **-6°C**?

Copy and complete these in the same way :-

- | | |
|-----------------------------------|------------------------------------|
| a 24°C is from 20°C | b 3°C is from 17°C |
| c 0°C is from 40°C | d 15°C is from -10°C |
| e -17°C is from 0°C | f 3°C is from -4°C |
| g -21°C is from -4°C | h -11°C is from 11°C |
| i 21°C is from -20°C | j -35°C is from 35°C. |

7. The temperature in the conservatory is -4°C.
The living room in the house is 23° warmer.

What is the temperature in the living room ?



8. As the plane rose from the airport into the sky, the outside temperature fell by a **steady amount** every 1000 metres.



At ground level, the temperature was 25°C and it fell by 10°C for every 1000 metres ascent.

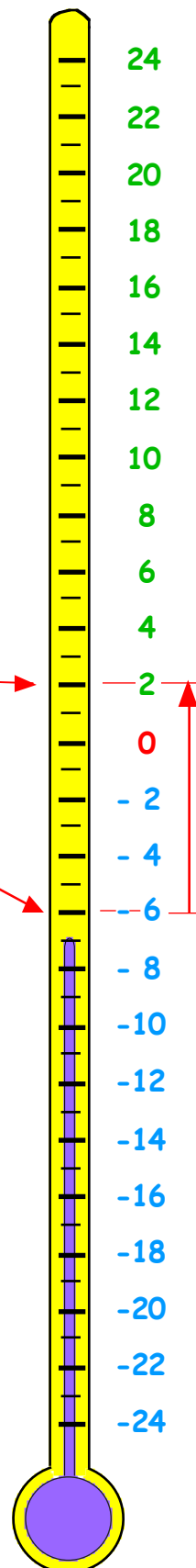
What was the temperature at :-

- | | |
|----------------------|--------------------------|
| a 1000 metres | b 3000 metres |
| c 5000 metres | d 10 000 metres ? |

9. When "Captain Icicle" breezes past, the temperature drops by 105°C !

This man was fishing in a daytime 30°C heat, but did not notice Captain Icicle passing by.

To what temperature did his surroundings drop ?

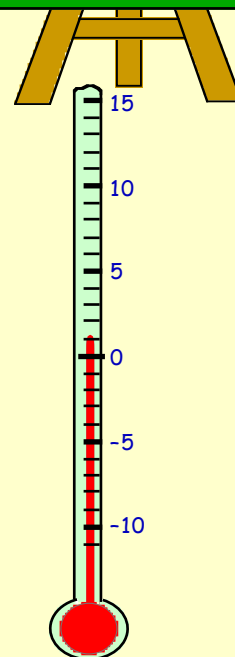


Adding and Subtracting Integers

When **adding** and **subtracting** integers, consider a thermometer and use the following **two step** method :-

- Example 1 :-** To find $(-1) + 5 \Rightarrow$
- picture the **first** number (-1)
 - then move (**up**) by 5 $\Rightarrow 4$
- Example 2 :-** To find $4 - 10 \Rightarrow$
- picture the **first** number (4)
 - then move (**down**) by 10 $\Rightarrow -6$
- Example 3 :-** To find $5 + (-9) \Rightarrow$
- picture the **first** number (5)
 - then move (**down**) by 9 $\Rightarrow -4$
- Example 4 :-** To find $(-6) + (-5) \Rightarrow$
- picture the **first** number (-6)
 - then move (**down**) by 5 $\Rightarrow -11$

Be able to add
& subtract
positive and
negative numbers



- So the basic rule is this :-
- if you **add on a (+) number** you move **up**.
 - if you **add on a (-) number** or **subtract a number** you move **down**.

Exercise 2

Draw a thermometer to help you.

1. Write down each question first, then the answer :-

- | | | | |
|--------------------------|--------------------------|-----------------------|----------------------------|
| a $8 + 9$ | b $5 + 11$ | c $0 + 29$ | d $11 + (-7)$ |
| e $9 + (-3)$ | f $5 + (-5)$ | g $1 + (-7)$ | h $4 + (-11)$ |
| i $0 + (-16)$ | j $(-4) + 11$ | k $(-9) + 9$ | l $(-2) + 13$ |
| m $(-8) + 5$ | n $(-12) + 3$ | o $2 + (-15)$ | p $(-7) + (-8)$ |
| q $(-10) + (-10)$ | r $(-12) + (-18)$ | s $(-13) + 5$ | t $(-24) + (-10)$ |
| u $(-50) + 20$ | v $(-25) + (-45)$ | w $30 + (-55)$ | x $(-2.6) + (-5.4)$ |



2. Again, use your thermometer to help here :-

(Remember :- $3 - 8$ means "start at 3, then move **down** by 8" $\Rightarrow -5$).

- | | | | |
|---------------------|-----------------------|-----------------------|-------------------------|
| a $12 - 7$ | b $18 - 18$ | c $27 - 9$ | d $2 - 4$ |
| e $4 - 9$ | f $3 - 11$ | g $0 - 14$ | h $(-1) - 7$ |
| i $(-6) - 4$ | j $(-13) - 7$ | k $(-1) - 24$ | l $0 - 25$ |
| m $18 - 38$ | n $(-14) - 24$ | o $100 - 400$ | p $(-61) - 39$ |
| q $0 - 26$ | r $(-13) - 13$ | s $7 - 21$ | t $(-28) - 32$ |
| u $(-1) - 1$ | v $(-53) - 17$ | w $(-18) - 18$ | x $(-1.5) - 6.5$ |

Subtracting Negative Numbers

Be able to recognise and use the double negative method

When asked the answer to $7 - (-3)$, the obvious answer is 4. **Wrong !!**

Think of a simpler question :-

$9 - 3$ means "how far is it from 3 up to 9 ?"

=> by counting, we can see the answer is 6.

This means that the question :-

$7 - (-3)$ means "how far is it from -3 up to 7 ?"

=> by counting, we see the answer is **10** (not 4).

Notice that $7 + 3$ also gives **10**.

A rule for **Double Negatives** :- "Two Negatives make a positive"

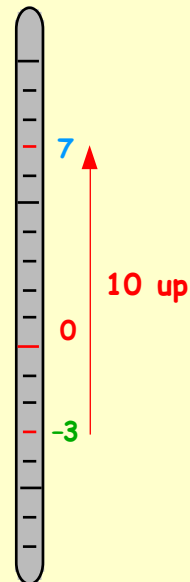
Examples :-

$$\begin{aligned} 5 - (-3) \\ = 5 + 3 \\ = 8 \end{aligned}$$

$$\begin{aligned} 15 - (-6) \\ = 15 + 6 \\ = 21 \end{aligned}$$

$$\begin{aligned} (-1) - (-8) \\ = -1 + 8 \\ = 7 \end{aligned}$$

$$\begin{aligned} -2x - (-7x) \\ = -2x + 7x \\ = 5x \end{aligned}$$



Exercise 3



1. Copy and complete the following :-

a $6 - (-4) = 6 + 4 = \dots$

b $10 - (-8) = 10 + 8 = \dots$

c $7 - (-2) = 7 + \dots = \dots$

d $20 - (-10) = 20 + \dots = \dots$

e $15 - (-8) = \dots + \dots = \dots$

f $9 - (-9) = \dots + \dots = \dots$

2. Show all the required steps in answering the following :-

a $8 - (-9)$

b $11 - (-12)$

c $0 - (-12)$

d $5 - (-14)$

e $19 - (-12)$

f $35 - (-15)$

g $13 - (-13)$

h $200 - (-300)$

i $16 - (-24)$

j $2.5 - (-5.5)$

k $5.9 - (-2.1)$

l $\frac{1}{4} - (-\frac{1}{4})$

m $(-1) - (-4)$

n $(-2) - (-8)$

o $(-9) - (-11)$

p $(-8) - (-6)$

q $(-1) - (-3)$

r $(-14) - (-6)$

s $(-23) - (-23)$

t $(-40) - (-80)$

u $(-27) - (-7)$

v $(-4.5) - (5.5)$

w $(-0.6) - (0.7)$

x $-\frac{1}{2} - (-\frac{1}{2})$

3. The same idea works with algebraic expressions. Find :-

a $5x - (-2x)$

b $6x - (-10x)$

c $0 - (-8a)$

d $7a - (-13a)$

e $3p - (-9p)$

f $11w - (-14w)$

g $8h - (-17h)$

h $80m - (-30m)$

i $(-2x) - (-6x)$

j $(-8x) - (-3x)$

k $(-7v) - (-7v)$

l $(-d) - (-4d)$

m $(-10w) - (w)$

n $(-10w) - (-w)$

o $(-8n) - (-12n)$

p $(-200q) - (-170q)$

Multiplication and Division of Integers

Be able to
 $\times$ and $\div$
positive and
negative numbers

Since $5 \times 8 = 40$, then obviously $5 \times (-8)$ cannot also be 40.

$5 \times (-8)$ means "5 lots of -8" = **-40**.

Examples :-

$2 \times (-3) = -6 \quad 9 \times (-5) = -45$

$(-10) \times 4 = -40 \quad (-7) \times 7 = -49$

Similarly :- Since $20 \div 2 = 10$, then obviously $(-20) \div 2$ cannot also be 10.

$(-20) \div 2 =$ "-20 shared by 2" = **-10**.

Examples :-

$(-18) \div 3 = -6 \quad (-28) \div 7 = -4$

$(-50) \div 10 = -5 \quad (-81) \div 9 = -9$

$5 \times (-8)$



Exercise 4



1. Write down each of the following and find the answers :-

a $3 \times (-4)$

b $5 \times (-6)$

c $2 \times (-8)$

d $8 \times (-8)$

e $(-9) \times 6$

f $(-10) \times 4$

g $(-11) \times 4$

h $(-8) \times 7$

i $9 \times (-5)$

j $7 \times (-4)$

k $4 \times (-20)$

l $10 \times (-10)$

m $15 \times (-1)$

n $(-30) \times 3$

o $(-5) \times 20$

p $(-80) \times 5$.

2. Copy each of the following and find the answers :-

a $(-18) \div 6$

b $(-25) \div 5$

c $(-49) \div 7$

d $(-45) \div 9$

e $(-14) \div 2$

f $(-60) \div 10$

g $(-55) \div 5$

h $(-36) \div 4$

i $(-7) \div 7$

j $(-19) \div 1$

k $(-63) \div 7$

l $(-200) \div 10$.

3. Work out :-

a $(3 \times 8) \div 6$

b $(4 \times (-10)) \div 5$

c $3 \times (-1) \times 7$

d $5 \times (-2) \times 8$

e $4 \times (-9) \div 6$

f $(-8) \times 6 \div 4$

g $6 \times (-4) \div 3$

h $20 \times (-10) \div 5$.

4. Find the following :- (hint : work out the bit in brackets first)

a $(7 + (-4)) \times 5$

b $6 \times (5 - 8)$

c $((-11) + 3) \times 2$

d $((-4) - 10) \div 2$

e $10 \times (12 - 15)$

f $(12 - 3) \times (-5)$

g $((-6) - 5) \times 4$

h $(8 + (-14)) \div 3$

i $((-19) - 11) \div 5$.

5. **a** What do you think the answer to $40 \div (-5)$ will be ? 8 or -8 ?

b If you think 8, check if $8 \times (-5)$ really takes you back to the original 40.

c If it doesn't, then the answer must be !

Note :- $18 \div (-3) = -6$ (not 6) (since $6 \times (-3) \neq 18$) $21 \div (-7) = -3$ (not 3) (since $3 \times (-7) \neq 21$).

In other words, if you divide two integers, where one of them is **positive** and one of them is **negative** $\Rightarrow$ the answer is always **negative**.

6. Write down each of the following and find the answers :-

- | | | | |
|-------------------------|--------------------------|--------------------------|--------------------------|
| a $20 \div (-5)$ | b $24 \div (-6)$ | c $18 \div (-9)$ | d $25 \div (-5)$ |
| e $36 \div (-4)$ | f $40 \div (-8)$ | g $7 \div (-1)$ | h $42 \div (-3)$ |
| i $96 \div (-8)$ | j $100 \div (-5)$ | k $120 \div (-6)$ | l $49 \div (-7)$ |
| m $1 \div (-1)$ | n $7 \div (-2)$ | o $30 \div (-4)$ | p $3 \div (-6)$. |

The **DOUBLE NEGATIVE** again :-

Remember :- Since $2 \times (-5) = -10 \Rightarrow (-2) \times (-5)$ cannot also be -10 !

$\Rightarrow$ The only other possibility is that $(-2) \times (-5) = +10$.

RULE 1 :- "When **two negatives** are **multiplied** $\Rightarrow$ the answer is **positive**"

Examples :- $(-4) \times (-6) = 24$ $(-5) \times (-8) = 40$ $(-8) \times (-10) = 80$

RULE 2 :- "When **two negatives** are **divided** $\Rightarrow$ the answer is **positive**"

Examples :- $(-21) \div (-3) = 7$ $(-32) \div (-8) = 4$ $(-48) \div (-6) = 8$

7. Write down each of the following and find the answers :-

- | | | | |
|-----------------------------|------------------------------|------------------------------|----------------------------------|
| a $(-2) \times (-4)$ | b $(-5) \times (-3)$ | c $(-6) \times (-9)$ | d $(-7) \times (-4)$ |
| e $(-6) \times (-8)$ | f $(-5) \times (-5)$ | g $(-13) \times (-1)$ | h $(-10) \times (-8)$ |
| i $(-9) \times (-9)$ | j $(-20) \times (-4)$ | k $(-3) \times (-60)$ | l $(-200) \times (-30)$. |

Copy each of these questions and set down the steps in each one to find the answer :-

8. **a** $(-15) \div (-5)$ **b** $(-21) \div (-3)$ **c** $(-32) \div (-4)$ **d** $(-18) \div (-2)$
e $(-45) \div (-9)$ **f** $(-32) \div (-8)$ **g** $(-54) \div (-9)$ **h** $(-80) \div (-2)$
i $(-63) \div (-7)$ **j** $(-150) \div (-5)$ **k** $(-800) \div (-10)$ **l** $(-147) \div (-3)$.
9. **a** $(3 \times (-8)) \div 6$ **b** $((-4) \times (-10)) \div 5$ **c** $3 \times (-4) \times (-5)$ **d** $5 \times (-8) \div (-4)$
e $(-6) \times (-6) \div (-4)$ **f** $(-10) \times 6 \div (-2)$ **g** $(5 + (-9)) \times (-7)$ **h** $(-8) \times (1 - 9)$
i $((-19) + (-2)) \div (-3)$ **j** $(-1) \times (-6) \times (-7)$ **k** $(-2) \times (-5) \times (-9)$ **l** $(-4) \times (-5) \times (-10)$
m $(-1)^2$ **n** $(-2)^2$ **o** $(-8)^2$ **p** $(-20)^2$
q $(-1)^3 (= -1 \times -1 \times -1)$ **r** $(-2)^4$ **s** $(-1)^7$ **t** $(-1)^{101}$.

Exercise 5**Mixed Exercise**

1. Find :-

- | | | | |
|-----------------------------|-----------------------------|------------------------------|------------------------------|
| a $6 - 9$ | b $-3 - 7$ | c $-2 + 10$ | d $-6 - 24$ |
| e $11 + (-2)$ | f $-7 + (-8)$ | g $7 - (-3)$ | h $9 - (-1)$ |
| i $-5 - (-5)$ | j $108 + (-148)$ | k $-108 - (-109)$ | l $-3 + (-3) + (-3)$ |
| m $-9 + (-2) - (-5)$ | n $-3 - (-3) + (-9)$ | o $-12 - (-8) - (-1)$ | p $-7 + (-8) - (-15)$ |

2. Work out :-

- | | | |
|---------------------------------|-----------------------------------|---------------------------------|
| a $2 + (-3) + 5 + (-8)$ | b $15 - (-9) + (-23) - 10$ | c $125 + (-130) - (-65)$ |
| d $-2 - (-3) - 5 - (-8)$ | e $15 + (-9) - (-23) + 10$ | f $-125 - (-130) - 65$ |

3. Find :-

- | | | | |
|-----------------------------------|-------------------------------------|---|------------------------------------|
| a $5 \times (-2)$ | b $(-3) \times 8$ | c $(-2) \times (-7)$ | d $(-8) \times (-10)$ |
| e $12 \div (-3)$ | f $(-20) \div 4$ | g $(-10) \div (-2)$ | h $(-24) \div (-6)$ |
| i $5 \times (-2) \times 3$ | j $(-30) \div 6 \times (-2)$ | k $(-1) \times (-2) \times (-3)$ | l $(-4) \times 1 \div (-8)$ |

4. Work out :-

- | | | |
|---|--|---|
| a $5 \times (-1) \times (-3)$ | b $12 \div (-2) \times (-9)$ | c $(-1) \times (-1) \times (-1) \times (-1)$ |
| d $-3 \times (-8) \div (-4) \div (-2)$ | e $-4 \times (-9) \div (-6) \div 6$ | f $(-6) \times (-5) \div (-10) - (-3)$ |

5. The balance in Marjory's bank account was £1000.

- She withdrew £230 on Monday,
- She deposited £85 on Tuesday,
- She withdrew £899 on Wednesday,
- She deposited £30 on Thursday.



Explain why she was contacted by her unhappy bank manager on the Friday.

6. a



Last winter, the temperature in a Norwegian village was recorded every evening at 10 pm for a period of 5 days.

The readings were :-

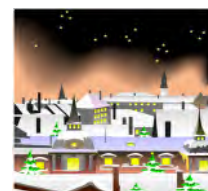
 $-17^{\circ}\text{C}, 3^{\circ}\text{C}, -2^{\circ}\text{C}, -5^{\circ}\text{C}, -9^{\circ}\text{C}.$ Find the **average*** temperature for the 5 days.

* To find the average of 5 numbers, add them together and divide your answer by 5.

b The temperature in a village in Sweden was also being recorded at the same time.

The readings there were :- $-9^{\circ}\text{C}, 1^{\circ}\text{C}, -19^{\circ}\text{C}, 0^{\circ}\text{C}, 2^{\circ}\text{C}.$ Which country had, on **average**, the **warmer** village of the two ?

Explain with working.



The 3 Я's

Revisit - Review - Revise



1. Find :-

- | | | | |
|----------------------|----------------------|-----------------------|-----------------------|
| a $7 - 10$ | b $-2 - 13$ | c $-7 + 8$ | d $-3 - 3$ |
| e $15 + (-8)$ | f $-4 + (-12)$ | g $10 - (-4)$ | h $6 - (-6)$ |
| i $-3 - (-1)$ | j $65 + (-75)$ | k $-27 - (-28)$ | l $-1 + (-2) + (-3)$ |
| m $-4 + (-5) - (-9)$ | n $-2 - (-2) + (-2)$ | o $-11 - (-3) - (-4)$ | p $-20 + (-1) - (-7)$ |

2. Find :-

- | | | |
|--------------------------|----------------------------|-------------------------|
| a $-3 + 4 - (-5) + (-6)$ | b $17 - (-11) + (-21) - 5$ | c $85 + (-91) - (-106)$ |
|--------------------------|----------------------------|-------------------------|

3. Find :-

- | | | | |
|---------------------------------|------------------------------|----------------------------------|-----------------------------|
| a $4 \times (-3)$ | b $(-5) \times 9$ | c $(-3) \times (-6)$ | d $(-11) \times (-5)$ |
| e $15 \div (-5)$ | f $(-30) \div 6$ | g $(-21) \div (-3)$ | h $(-45) \div (-9)$ |
| i $4 \times (-5) \times 2$ | j $(-40) \div 8 \times (-3)$ | k $(-3) \times (-2) \times (-1)$ | l $(-6) \times 2 \div (-3)$ |
| m $(-21) \times (-11) \times 0$ | n $(-2) \times (-2) + (-2)$ | o $(-30) \div (-6) \times (-2)$ | p $(-1) + (-2) \times (-3)$ |

4. Find :-

- | | | |
|--------------------------|-------------------------------------|---|
| a $5 - (-1) \times (-3)$ | b $-3 \times (-8) + (-4) \div (-2)$ | c $(-1) \times (-1) - (-1) \times (-1)$ |
|--------------------------|-------------------------------------|---|

5. On 29th January, Alex's bank balance read **-£455**.

- a Describe "a balance of -£455" another way.

His monthly salary of £1475 was paid in the next day and Alex then sent off a cheque for £175 for his season ticket.

- b Write down Alex's new balance.



6. a



In an experiment, a scientist froze a flask of liquid from 5°C down to -32°C .

By how much had the liquid's temperature dropped ?

- b Senator Rovicus arrived in Britain in 23 BC and sailed back to Rome in the year 19 AD.

For how long had Rovicus been away ?



c



A small submarine was on the ocean bed at a depth of -155 metres. It rose to a depth of -68 metres before descending by 52 metres. How far above the ocean bed was the sub at that time ?

CHAPTER 5

Coordinates

Coordinates in 4 Quadrants

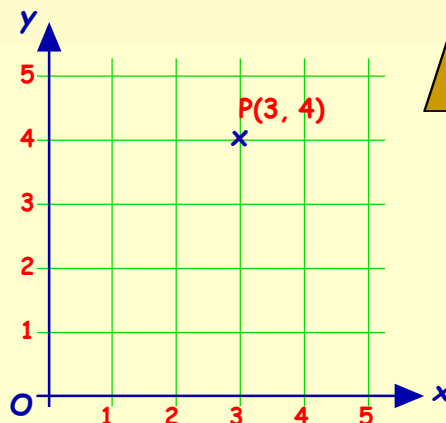
Revision :- You should know what a Coordinate diagram, (or a **Cartesian** diagram), looks like.

Remember :-

- **x-axis** (or horizontal axis).
- **y-axis** (or vertical axis).
- The **origin** (O).

P is 3 (**right**) and 4 (**up**) from the origin.

$\Rightarrow$ **P(3, 4)**, has x-coordinate 3 and y-coordinate 4.



We now extend the set of x and y axes **backwards** and **downwards**.

Look at the numbers on the x and y - axes. They now include **NEGATIVE** values.

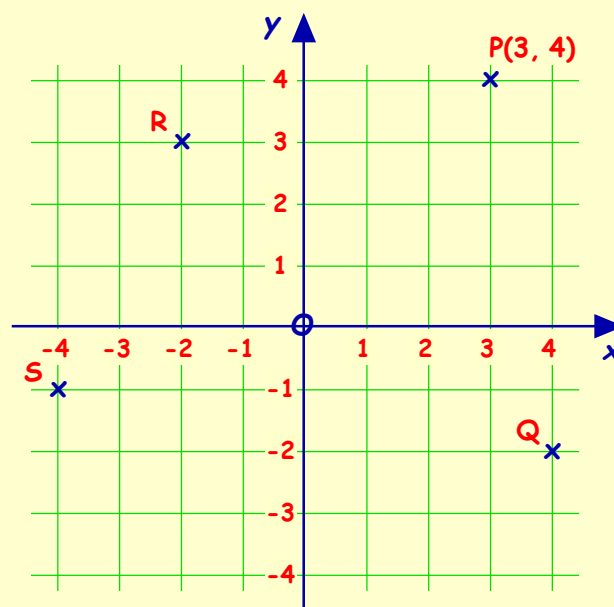
The point Q is 4 (to the right) and 2 (down) from the origin

$\rightarrow$ **Q(4, -2)**.

The point R is 2 (to the left) and 3 (up) from the origin

$\rightarrow$ **R(-2, 3)**.

The point S is 4 (to the left) and 1 (down) from the origin $\rightarrow$ **S(-4, -1)**.

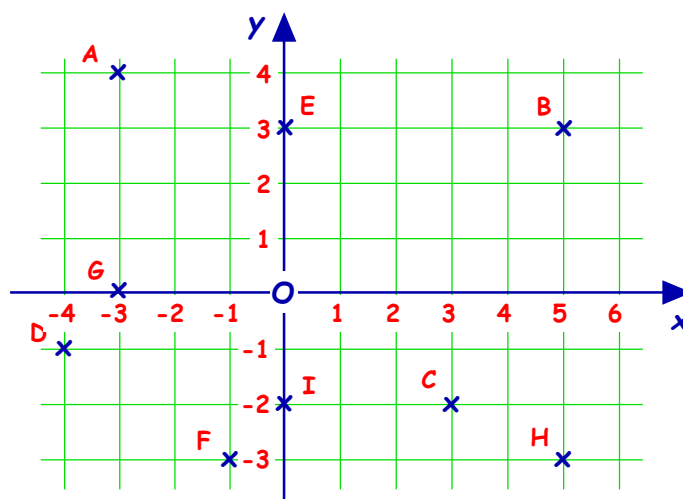


Exercise 1

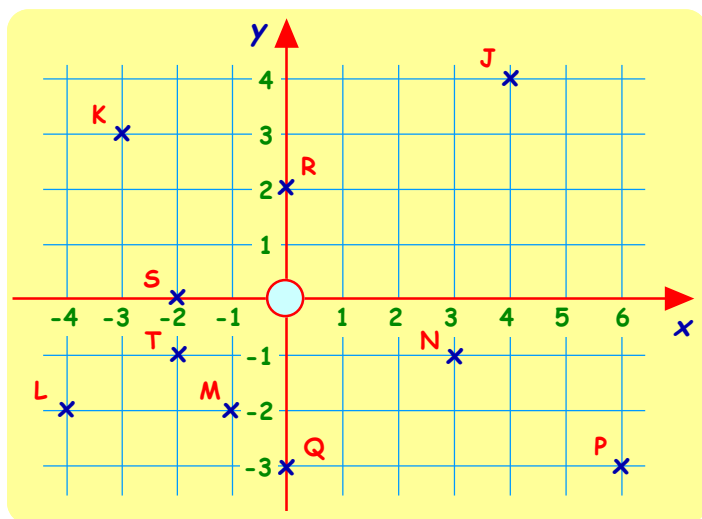
1. Look at this coordinate diagram. The coordinates of A are

A(-3, 4).

Write down the coordinates of the other 8 points.



2. Write down all the coordinates :-
- of all the points from **J** to **T**
 - that lie on the x - axis
 - that lie on the y axis
 - that have an x coordinate of -2
 - that have a y coordinate of -1
 - that have the same x coordinate
 - that have the same y coordinate
 - that have the same x and y coordinate.



3. a Copy the Cartesian coordinate grid from question 2.
- b Plot the following points on your diagram :-
- A**(4, 1), **B**(-2, 3), **C**(-1, -1), **D**(0, 3), **E**(-5, 0), **F**(-4, -3),
G(0, -3), **H**(6, -3), **I**(-2, -3), **J**(5, -1), **K**(-3, 3), **L**(-3, -3).

4. Draw a **large** set of axes (-10 to 10 on both scales).

Plot each set of points, join them up and state what shape is formed each time :-

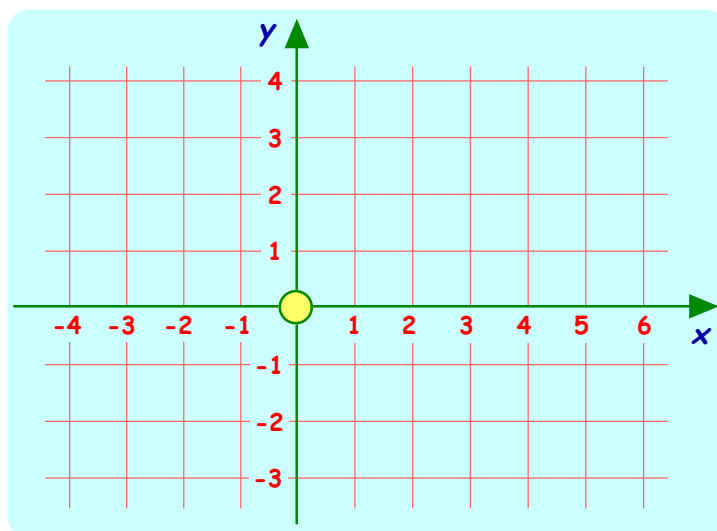
- A**(3, 3) **B**(5, 4) **C**(7, 3) **D**(5, -2).
- E**(-7, 5) **F**(-5, 8) **G**(2, 8) **H**(0, 5).
- I**(-10, 3) **J**(-8, 3) **K**(-9, -3).
- L**(1, -5) **M**(-4, -4) **N**(-5, 1) **O**(0, 0).
- P**(4, -5) **Q**(6, -7) **R**(5, -9) **S**(3, -9) **T**(2, -7).
- U**(-8, -3) **V**(-6, -3) **W**(-5, -5) **X**(-6, -7) **Y**(-8, -7) **Z**(-9, -5).

5. a Copy this diagram and plot the points **P**(-3, 2), **Q**(5, 2) and **R**(5, -3).

- b Try to find a 4th point, (call it **S**), such that **PQRS** is a **rectangle**.

Show **S** on your diagram, and write down its coordinates.

- c Draw the diagonals of the rectangle and state the coordinates of their intersection.



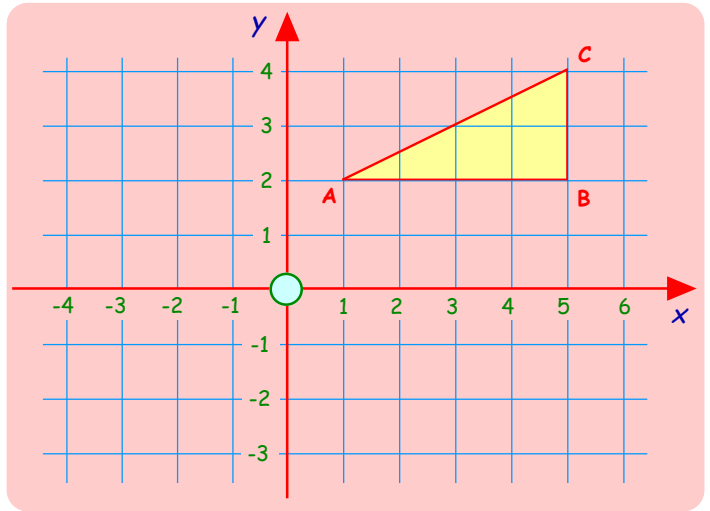
6. A parallelogram has 3 of its vertices (corners), at $(-2, 4)$, $(5, 3)$ and $(2, -2)$.
- Plot these points on a Cartesian diagram.
 - Find the coordinates of the other vertex.

7. Look at triangle ABC.

- Write down the coordinates of the 3 points, **A**, **B** and **C**.
- "Flip" triangle **ABC** over the x-axis. (This is called "**REFLECTING**" the shape).

Write down the new coordinates of the corners of the triangle (call them **A'**, **B'** and **C'**).

- Now "**flip**" your new triangle **left** across the y-axis and write down the coordinates of the 3rd triangle (**A''**, **B''**, **C''**).



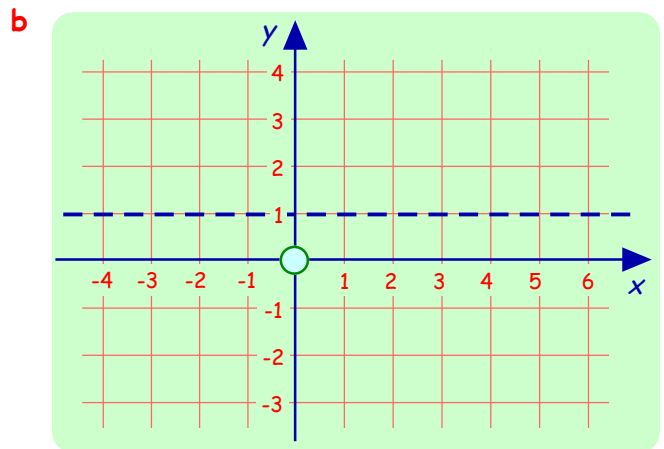
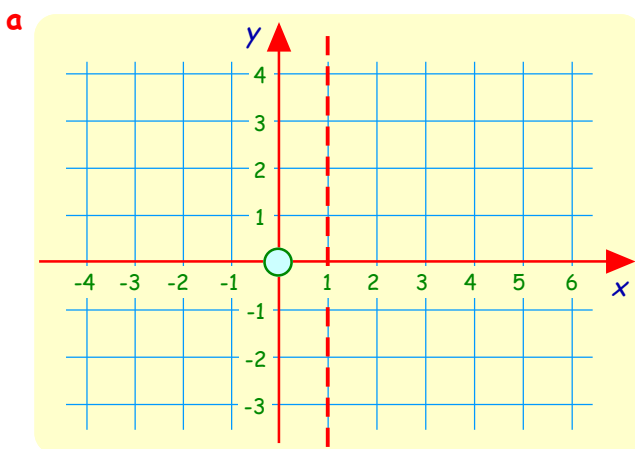
- Draw a set of axes, (-8 to 8 on both scales) and plot the four points **E**(2, 1), **F**(3, 6), **G**(5, 6), **H**(6, 1).
- Join the four points and state what type of shape is formed.
- Reflect** each of the four points over the x-axis to form a new four-sided shape, **E'F'G'H'**.
- Write down the coordinates of the four corners of this new reflected shape.

9. Draw a new set of axes from -8 to 8 on both scales.

- Plot the 4 points **P**(0, 1), **Q**(-1, 6), **R**(-4, 7) and **S**(-5, 2) and join them up.
- Reflect** your shape over the y-axis and write the coordinates of your new shape.
- Reflect** the **original** shape over the x-axis and write the coordinates of your new shape.

10. For each of the sets of axes below :-

- plot the square with points **I**(3, 2) **J**(5, 2) **K**(5, 4) and **L**(3, 4),
- reflect the square over the dotted line (use **I'**, **J'** etc).



11. Repeat question 10 (ii) for the triangle with vertices **M**(-1, -2) **N**(-4, -2) and **P**(-3, -3).

12. Repeat question 10 (ii) for the triangle with vertices **Q**(1, 0) **R**(-3, 4) and **S**(2, 3).

13. Take a new page in your jotter and in the **middle**, draw a set of axes **lightly** in pencil.

The x -axis is numbered -12 to 12.

The y -axis is numbered -20 to 20.

Use tiny dots to mark each point in the following sets and join them up neatly.

When all the sets, **A** to **K**, are drawn, a familiar figure should appear.

Set A (-6, -17) (-4, -17) (-6, -12)
 (-4, -8) (8, -2) (9, 1) (-4, -8)
 (-8, -8) (-9, -2) (-9, 4) (-10, 6)
 (-9, 9) (-7, 9) (-7, 13) (-10, 14)
 (-8, 15) (-5, 15) (-6, 17) (4, 13)
 (3, 16)

Set B (5, 16) (4, 13) (8, 13) (10, 12)
 (8, 11) (6, 12) (7, 13) (5, 11)
 (3, 10) (3, 11) (1, 13) (2, 10)
 (-2, 13) (-7, 14)

Set C (5, 11) (6, -1)

Set D (3, 6) (5, 6) (3, 4)

Set E (-6, -17) (-8, -15) (-6, -12)
 (-8, -8) (-10, -7) (-9, -6)

Set F (-5, -6) (-7, -2) (-5, -2) (0, 1)
 (-1, 5) (1, 0)

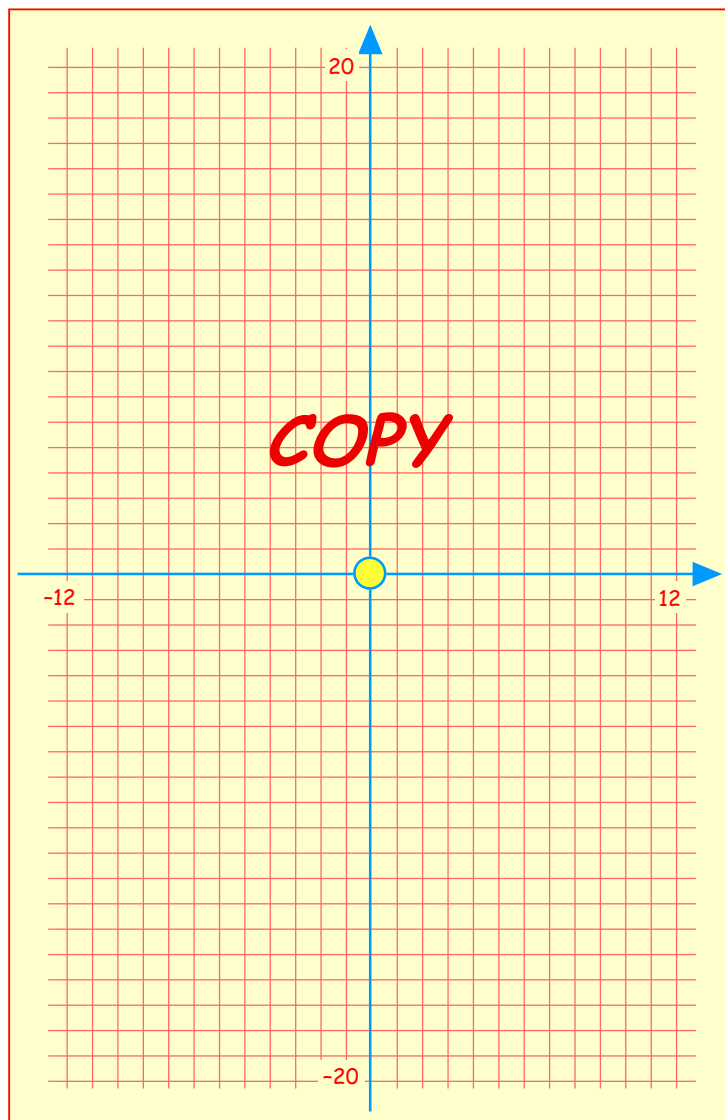
Set G (-9, 4) (-7, 3) (-4, 4) (-2, 7) (2, 2) (1, -4)

Set H (-7, 11) (-4, 8)

Set I (-3, 9) (-2, 8) (0, 5)

Set J (-5, 12) (-6, 10) (-5, 9) (-4, 11) (-5, 12)

Set K (-2, 12) (-3, 10) (-2, 9) (-1, 10) (-2, 12). Have Fun !!!!! — **Who is it ?**



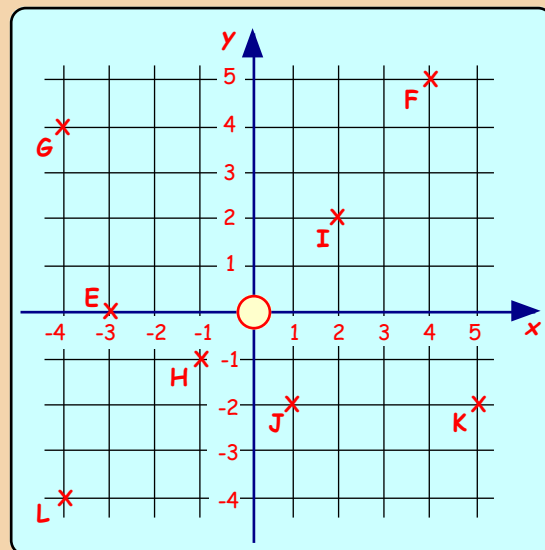
14. Draw an axes grid with both x and y from -18 to 18.

Use tiny dots to mark each point in the following sets and join them up neatly.

(9, 2), (8, 4), (9, 4), (9, 6), (10, 5), (11, 5), (9, 0), (10, 0), (8, -3), (9, -3),
 (5, -6), (3, -7), (2, -9), (3, -11), (3, -12), (-2, -17), (-3, -16), (-4, -17),
 (-4, -15), (-5, -15), (-3, -13), (-2, -14), (-1, -11), (-2, -8), (-3, -8), (-5, -10),
 (-7, -11), (-8, -11), (-8, -10), (-9, -10), (-8, -9), (-9, -8), (-6, -8), (-5, -6),
 (-2, -5), (-3, -2), (-10, -4), (-11, -4), (-11, -3), (-12, -3), (-11, -2), (-12, -1),
 (-10, -1), (-9, -2), (-6, 0), (-9, 1), (-10, 4), (-12, 4), (-11, 5), (-12, 7), (-11, 7),
 (-11, 8), (-9, 7), (-9, 5), (-8, 3), (-4, 2), (-3, 5), (-5, 5), (-5, 6), (-3, 6),
 (-5, 7), (-6, 9), (-3, 9), (-2, 11), (2, 11), (4, 13), (4, 10), (6, 7), (4, 7), (5, 5),
 (3, 5), (4, 3), (8, 3), (4, 1), (3, 1), (3, -5), (4, -5), (7, -2), (7, 0), (5, -1), (9, 2).

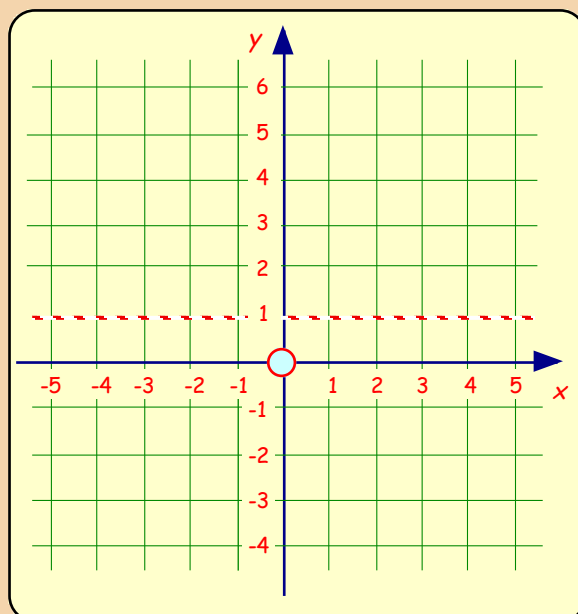
What is it ?

1. From the coordinate diagram :-
 - a Write down the coordinates of the points :-
(i) F (ii) J (iii) E (iv) G.
 - b Which points have the same **x coordinate** ?
 - c Which points have the same **y coordinate** ?
 - d Which points have the same **x and y coordinate** ?



2. Draw a set of axes similar to question 1, but make both axes **-8 to 8**.
 - a Plot the following points and join them up in order to reveal a **geometric shape**.
 $A(-3, 5) \rightarrow B(3, 4) \rightarrow C(5, -2) \rightarrow D(1, -6) \rightarrow E(-5, -5) \rightarrow F(-7, 1) \rightarrow A(-3, 5)$
 - b What is the name of the shape you have just formed ?
 - c Join A to D, B to E and C to F.
Write down the coordinates of the point where these three lines cross ?
3. Draw another set of axes (**-6 to 6 on both scales**).
 - a Plot the points P(-4, 2), Q(1, 3) and R(4, -6).
 - b Plot a 4th point (S) so that figure PQRS is a **kite** with PR a **line of symmetry**, and write down the coordinates of point S.

4. Copy the set of axes shown opposite.
 - a Plot the points R(1, 0), S(5, -2) and T(3, -4).
 - b Describe clearly what kind of triangle RST is.
 - c Reflect RST in the **y-axis**, showing its new position in your diagram, (R'S'T').
 - d Now give your new triangle a reflection over the dotted line, showing its newest position on your diagram, (R''S''T'')
 - e After both reflections, what is the **new** coordinates of the point which was originally S(5, -2) ?



CHAPTER 6

Percentages, Fractions & Decimals

Finding a Percentage Without a Calculator

Remember - Many Percentages can be reduced to simple fractions.

To find 25% of something you divide by 4.

20% of something you divide by 5, etc.....

To find 75% of £80 = $\frac{3}{4}$ of £80 = $(80 \div 4) \times 3 = \text{£60}$

Be able to find a percentage of a quantity without a calculator

percentage	50%	25%	75%	$33\frac{1}{3}\%$	$66\frac{2}{3}\%$	20%	40%	60%	80%	10%	30%	70%	90%
fraction	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{4}{5}$	$\frac{1}{10}$	$\frac{3}{10}$	$\frac{7}{10}$	$\frac{9}{10}$

Examples :-

To find 3%

- first, find 1%, ($\div 100$)
- then times by 3. ($\times 3$)

To find 90%

- first find 10%, ($\div 10$)
- then times by 9. ($\times 9$)

To find 13%

- first find 10%, ($\div 10$)
- then find 3% (see opp.)
- then add them both.

Exercise 1



1. Find the following without a calculator :-

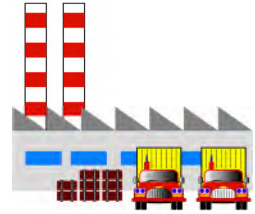
- | | | |
|----------------------------------|--------------------------------|------------------------------|
| a 10% of £15 | b 70% of £50 | c 20% of £5.50 |
| d 80% of 400 kg | e 25% of 1260 kg | f $33\frac{1}{3}\%$ of 48 kg |
| g 75% of £6.40 | h 1% of 120 cm | i 60% of 12000 km |
| j 50% of £ $\frac{1}{2}$ million | k $66\frac{2}{3}\%$ of 18.6 ml | l 10% of 7 m |
| m 2% of £800 | n 3% of 50 mm | o 5% of £5. |

2. **Difficult** Find the following :- (You may wish to jot down your in-between working).

- | | | |
|------------------------------|-----------------|--------------------|
| a 11% of £20 | b 15% of £60 | c 3% of £32 |
| d 8% of 3000 m | e 5% of 1260 ml | f 2% of 45000 mm |
| g 11% of 50000 g | h 12% of £1200 | i 90% of 40000 kg |
| j $12\frac{1}{2}\%$ of £1600 | k 4% of £1150 | l 110% of \$810 |
| m 0.5% of 8600 ml | n 1.5% of £500 | o 2.5% of 1600 km. |

3. There are 360 employees in a factory, 10% of them are women.

- a What percentage of employees are men ?
- b How many men work in the factory ?



4. A shop selling a new bike costing £120 gives a 20% **discount**.



- a How much is the **discount** ?
- b How much will the bike now cost ?

Discount means money off.

A bicycle helmet priced at £30 is given a 30% **discount**.

- c How much will the helmet cost now ?

5. Heather puts £450 into a bank which gives an **interest** of 5% every year.
How much interest will she get after one year ?

Interest is money usually added on.



6. Alicia has £820 to invest in a bank.
How much **more** interest will she get by putting her money into Scotty Bank ?
(p.a. means per annum - per year).

Scotty Bank

5% interest p.a.

Scotia Bank

3% interest p.a.

7. a A University noticed that twelve and a half percent of new students dropped out in their first year.
If there were 1280 first year students, how many dropped out ?

b Of a group of 800 people surveyed :-

30% read the Sun, 45% read the Record, 15% read the Herald and the rest read the Express.



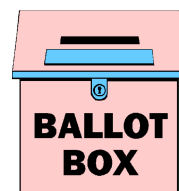
How many of the 800 people read the :-

- (i) Sun
- (ii) Record
- (iii) Herald
- (iv) Express ?

8. The diameter of Mars is only 55% of the Earth's diameter.
If the diameter of Earth is 14 000 km, what is the diameter of Mars ?



9. In a school election only 22.2% voted for the Head Boy.
If 2000 pupils voted, how many voted for the Head Boy ?



Finding a Percentage With a Calculator

Remember - When using a calculator make sure you show **all** your working.

Example :- Find 17% of £1860.

$$\begin{aligned}\frac{17}{100} \times £1860 &= (17 \div 100) \times £1860 \\ &= 316.2 \\ &= \text{£}316.20\end{aligned}$$



Be able to find a percentage of a quantity with a calculator

Exercise 2

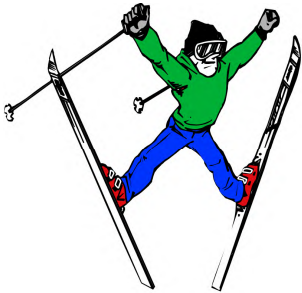


1. Find the following using a calculator :-

- | | | |
|-----------------|--------------------------------|------------------------|
| a 13% of £1500 | b 72% of 520 km | c 28% of £50.50 |
| d 81% of 420 ml | e 22.5% of 120 kg | f 33% of 480 mm |
| g 79% of £60 | h 14% of 120 cm | i 60% of 12 000 km |
| j 18% of 7 cm | k $66\frac{2}{3}\%$ of 28.5 km | l 23% of £0.25 million |
| m 101% of £800 | n 125% of 150 km | o 150% of £5. |

2. a On red nose day, 24% of pupils at Clydebanks High wore a red nose. If there were 1400 pupils, how many wore a red nose ?

b 43% of 1600 people asked in a survey preferred cats rather than dogs. How many people in the survey preferred cats ?

c  There were 5850 people using a ski slope yesterday. 32% of them had never been skiing before. How many had never been skiing before ?

d The cost of using the ski slope was £45 per day. A 12% **discount** was given yesterday. How much money was taken off the price yesterday ?

e Salters Suits give a 37% **discount** on a £680 suit. How much would I **have to pay** for the suit ?

f Jake weighed 87 kg and wanted to **lose** 8%. How much did Jake want to weigh ?



3. a Zara, who weighed 70 kg, found that after training for a Marathon her weight had dropped by 13%.

- (i) By how much had Zara's weight dropped ?
(ii) How much does Zara weigh now ?

- b Zara's last Marathon time was exactly 3 hours.
She wanted to beat this time by at least 10%.

What time did she want to achieve in this Marathon ?



4. a



A shopkeeper sold his TIKTOK watches at £120 each.
He decided to raise the price by 15%.

- (i) How much was the increase ?
(ii) How much does the watch now cost ?

- b

Leather watch straps cost £18 each.

What would be the cost if the price was reduced by 11% ?

5. a Peter poured 12 litres of juice into a large punch bowl for his *Save The Children* fundraising party.

After the party there was only 8% of the juice left.

How many millilitres had been drunk at the party ?

- b Peter beat last year's total (£1850) by 18%.

How much money did he raise this year ?



- 6.



Shop A had a football strip priced at £70 but had a 12% discount sticker.

Shop B had the strip marked £75 but with a 21% discount sticker.

Which shop had the cheaper football strip ? (Explain).

7. Two flats each cost £80000.

A year later Flat 1 had an increased valuation at 12%.

Flat 2 had its value decreased by 9%.

- a What profit will Flat 1 make on its property ?
b What is the difference between the two Flats' prices now ?



8. Alice was given a £25 discount on a £250 outfit.
What percentage discount was she given ?

Linking Fractions, Decimals & Percentages

Remember - $\frac{19}{100} = 19 \div 100 = 0.19 = 19\%$.

We can change **any fraction** into a **decimal**, and then change it into a **percentage**.

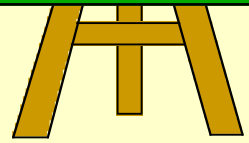
Examples :-

Change each of the following fractions into a decimal then into a percentage :-

1. $\frac{3}{50} = 3 \div 50 = 0.06 = 6\%$

2. $\frac{3}{4} = 3 \div 4 = 0.75 = 75\%$

Be able to convert between a fraction, decimal & percentage



Exercise 3



1. Copy and complete each of the following :-

a $\frac{7}{25} = 7 \div 25 = 0.\dots = \dots\%$

b $\frac{8}{10} = 8 \div \dots = 0.\dots = \dots\%$

c $\frac{3}{5} = \dots \div \dots = 0.\dots = \dots\%$

d $\frac{18}{40} = \dots \div \dots = 0.\dots = \dots\%$

2. Change each of the **fractions** shown to a **decimal** then to a **percentage** :-

a $\frac{12}{60}$

b $\frac{6}{40}$

c $\frac{4}{5}$

d $\frac{56}{200}$

e $\frac{87}{150}$

f $\frac{14}{140}$

3. **Carefully**, change each of these **fractions** to **percentages** :-

a $\frac{1}{5}$

b $\frac{7}{35}$

c $\frac{12}{20}$

d $\frac{22}{110}$

e $\frac{9}{30}$

f $\frac{222}{5550}$

Remember :- answers like 0.1 does **NOT** mean 1%.

The "1" is in the **tenths** column so **0.1 = 10%**.

4. a Bobby scored $\frac{60}{80}$ in a Maths test. Change his score to a percentage.

b Sarah scored $\frac{32}{40}$ in an Art exam. Change her score to a percentage.

5. Jack scored $\frac{69}{92}$ in his English test, $\frac{56}{70}$ in his French test and $\frac{39}{50}$ in his History test.

a Change each mark to a percentage.

b In which subject did he score the **highest** test mark ?

c In which subject did he score the **lowest** test mark ?



6. Change each of these test scores to percentages in the same way :-

- | | | | |
|----------|--------------|----------------|--|
| a | Sara scored | 24 out of 30 | $\left(= \frac{24}{30} = 24 \div 30, \Rightarrow 0\cdot \dots\dots, \Rightarrow \dots\dots \% \right)$  |
| b | Tam scored | 9 out of 15 | |
| c | Jane scored | 36 out of 75 | |
| d | Dan scored | 32 out of 50 | |
| e | Lynne scored | 17 out of 20 | |
| f | Jen scored | 49 out of 70 | |
| g | Lynda scored | 108 out of 120 | |
| h | Jim scored | 27 out of 36. | |



7. Answer each of these questions which relate to question 6.

- a** Who had the top mark ? **b** Who had the lowest mark ?

8. The number of girls in the top 4 Maths classes was noted.

$$2X_1 = \frac{18}{30} \text{ (18 out of 30)} \qquad 2X_2 = \frac{21}{28}$$

$$2X_3 = \frac{16}{25} \qquad 2X_4 = \frac{18}{24}$$



- a What percentage of each class was girls ?
- b What percentage of each class must have been boys ?

9. Put each of the following lists in order, **smallest** first :-

- a** $0.5, \frac{40}{50}, 45\%$ **b** $77\%, 0.8, \frac{19}{25}$ **c** $17\%, \frac{1}{6}, 0.2, \frac{2}{13}$.

10. Put each of these lists in order, **largest** first :-

- a** $33\frac{1}{3}\%$ of £540, $\frac{4}{9}$ of £297, $0.28 \times$ £520, 20% of 50% of £1560
- b** $0.85 \times$ 240, 65% of 320, $\frac{2}{3}$ of 300, half a percent of 42 000.

11. James was given a car insurance quote for £640 by *I-insure*.

E-insure quoted him 90% of his *I-insure* quote.

CarInsure offered a quarter **off** *E-insure's* quote.

James opted for **CheapInsure**, who offered 0.2 off **CarInsure's** quote.

How much did James pay for his car insurance ?



12. Make up some questions of your own similar to question 11.

Ask your partner to solve them.

The 3 Я's

Revisit - Review - Revise



This page is the non-calculator section.

1. Change each percentage to a decimal and then to a fraction in its simplest form :-

- | | | | |
|---------------------|---------|---------------------|---------|
| a 25% | b 45% | c 10% | d 15% |
| e 31% | f 17.5% | g 56% | h 100% |
| i $33\frac{1}{3}\%$ | j 4% | k $66\frac{2}{3}\%$ | l 150%. |

2. Change each of the following into a percentage :-

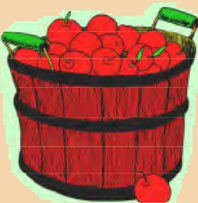
- | | | | |
|------------------|-----------------|-------------------|------------------|
| a 0.55 | b 0.3 | c 0.07 | d 0.90 |
| e $\frac{3}{10}$ | f $\frac{3}{5}$ | g $\frac{19}{20}$ | h $\frac{9}{25}$ |
| i 1.2 | j 0.005 | k $1\frac{1}{2}$ | l 0.01. |

3. Find :-

- | | | |
|-----------------------------|--------------------------------|---------------------|
| a $\frac{7}{10}$ of £120 | b $\frac{3}{5}$ of 90 kg | c 1% of £2400 |
| d 75% of 480 ml | e $12\frac{1}{2}\%$ of £40 000 | f 0.2 of 150 litres |
| g $33\frac{1}{3}\%$ of £450 | h 0.8 of €5000 | i 91% of 3000 m. |

4. a Kev bought a second hand pickup for £3500.
He sold it 6 months later at **10% less** than
what he paid for it.
How much did Kev sell the pickup for ?



- b  Mrs Woods bought in 150 apples for the nursery children.
She discovered **three fifths** of them were bad.
How many of the apples was she then able to use ?

- c RyanJet's flight prices **rose by 25%** this year.
I flew to Rome last year for £84.
How much will it cost this year ?



- d  My weight on Friday was 140 pounds.
After over-indulging at the weekend, my weight rose by 2%.
How much did I weigh on Monday morning ?

This is a calculator section.



5. Find :-

- | | | | | | |
|---|-------------------------|---|---|---|-------------------------------|
| a | 15% of £230 | b | $\frac{3}{7}$ of 1246 kg | c | 9% of £3600 |
| d | 0.35 of £12.40 | e | $87\frac{1}{2}\%$ of £32 000 | f | $\frac{7}{15}$ of 3450 tonnes |
| g | $\frac{1}{2}\%$ of £450 | h | 0.7 of $17\frac{1}{2}\%$ of $\frac{4}{5}$ of €4000. | | |

6. a



Ken's salary last year was £24 360.

This year he received a **pay rise** of 4.5%.

What is Ken's new (i) annual salary (ii) monthly salary ?

- b A new packet of Zad washing powder claims to have **24% more** powder.
The old packet stated that it could do 75 family washes.
How many washes can the new packet do ?



7. a



Jackie's Sports Emporium bought in 40 footballs for a total of £216.

The manager hopes to make a 35% profit by selling all the balls.

What must they sell each ball for to make the required profit ?

- b 256 000 people were registered to vote in last year's Council Elections.
The turnout was only 37.5%. How many people failed to vote ?



8.



A fruit grower planted 675 apple seedlings last year.

16% of them perished during the winter frost.

How many of the seedlings survived ?

9. List these people in order, beginning with the one with the **largest** new salary.

- George earns £400 per week and gets a weekly rise of £32.
- Laura earns £22 000 per year and is given a 4.5% wage rise.
- Charlie is paid £1750 per month and his pay rises by a twentieth.

10.



Jack and Jill bought a 3 piece suite from FDS furnishings.

They bought it by making a deposit of 12% of the cash price followed by 24 monthly payments of £69.50.

How much more expensive was this than the cash price ?

CHAPTER 7

Algebra

Simplifying Algebraic Expressions

Examples :-

Collect Like Terms

$$a + a + a + a = 4a$$

$$12m - 7m = 5m$$

$$5x + y - x + 7y = 4x + 8y \text{ (not } = 12xy)$$

$$14 + 3k - 3 = 11 + 3k \text{ (not } = 14k)$$

$$h^2 + h^2 + h^2 = 3h^2 \text{ (not } h^6)$$

Multiply Terms

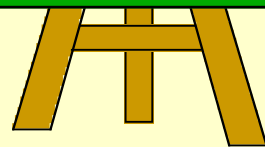
$$9 \times p = 9p$$

$$h \times 8 = 8h$$

$$w \times w = w^2 \text{ (not } = 2w)$$

$$5m \times 6m = 30m^2 \text{ (not } 30m)$$

Be able to collect "like" terms & multiply terms in algebraic expressions



Divide Terms

$$14a \div 2a$$

$$= 14\cancel{a} \div 2\cancel{a}$$

$$= 7$$

$$18p^2 \div 9p$$

$$= 18 \times p \times \cancel{p} \div 9\cancel{p}$$

$$= 2p$$

Exercise 1



1. Simplify the following expressions by collecting like terms :-

a $p + p$

b $k + k + k$

c $w + w + w + w + w$

d $x - x + x$

e $y + y - y + y$

f $h + h + h - h - h$

g $p + 3p - 2p + p$

h $8k + 4k - 10k + k$

i $6w - 5w - 2w + w$

j $x + y + 2x$

k $a + a + b - b$

l $2g + h - g + h$

m $9m - n - 8m + n$

n $3x + 7x - 1$

o $8 + 2a - 3$

p $9 - 2p + 3p - 9$

q $6 + 5u - 4u$

r $3p + 8q + 6p - 7q$

s $5g + h - 6g + 3h$

t $a + 3b - a - 3b$

u $1 + 2x - x + 3$

v $20 - k + 11k - 19$

w $10 - 6w - 1 + 6w + w$

x $a + b - a + b + 2a - b$

y $x^2 + x^2 + x^2$

z $p^2 + q^2 - p^2 + q^2$

2. Simplify by multiplying (or dividing) :-

a $8 \times p$

b $w \times 4$

c $m \times m$

d $d \times d \times d$

e $12 \times e$

f $h \times 0.5$

g $n \times 1.2$

h $y \times y \times 5$

i $6 \times u \times 8$

j $8p \times 7$

k $12 \times c \times c$

l $p \times q \times 3$

m $w^2 \times w$

n $u \times u^2$

o $a \times 9b$

p $3p \times 5q$

q $3y \times y \times y$

r $5g \times 2g \times g$

s $4h^2 \times 5h$

t $(2q)^2$ i.e. $(2q \times 2q)$

u $8p \div 2p$

v $20m \div 2m$

w $18ab \div 9a$

x $10x^2 \div 5x$

y $18x^2 \div 6x$

z $30x^2 \div 10x$



3. Simplify the following expressions :-

a $x^2 + 6x^2$

b $a \times 5a$

c $7k \times k$

d $20y - 12y$

e $7n \times 3n$

f $8m \times 4n$

g $16d + 14d$

h $7e \times 9e$

i $2y \times 50x$

j $6a - a$

k $4a \times 3b \times a$

l $42m \div 6m$

m $19f + f$

n $13x + x - 4y$

o $1 + 2z - z$

p $a^2 \times 2a + 2$

q $8x^2 - x^2$

r $7m - n + m$

s $10u + 10 - 9u$

t $50x^2 \div 10x$

u $5 - 2a + 3$

v $5g - 2 + 3g$

w $3v - 2v - v + 1$

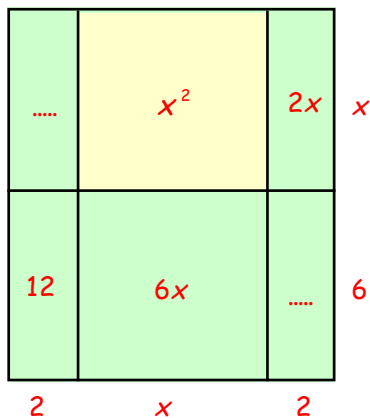
x $7x^2 - 6 + x^2$

y $9p^2 - 8p^2 + 7p^2 - 8$

z $63k^2 \div 9k$.

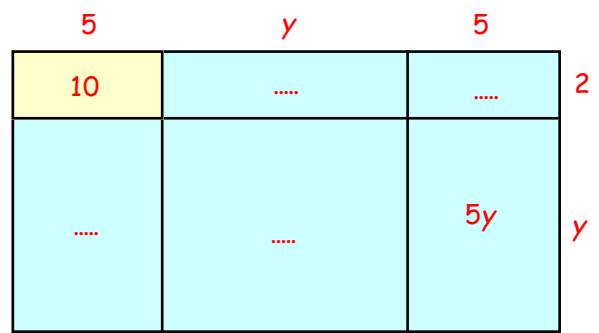
4. For each rectangular design, find an expression for the area of each small rectangle then find the **total area** of the design in its **simplest form**. (Ignore units !)

a



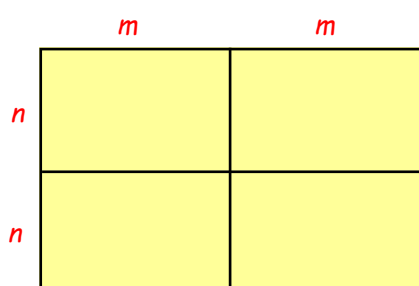
Area = $(6 \times 2) + (6 \times x) + (6 \times 2) + (2 \times x) + \dots + \dots$

b

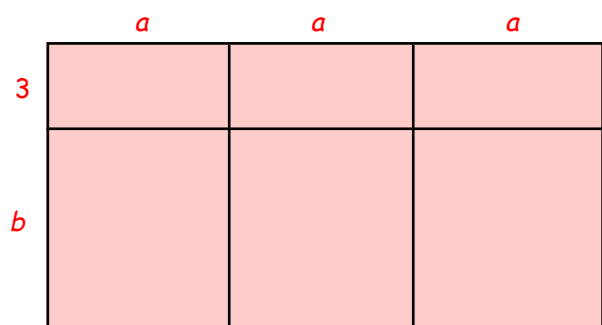


Area = $\dots + \dots + \dots + \dots$

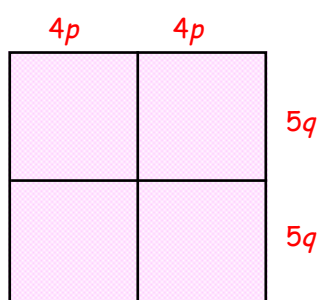
c



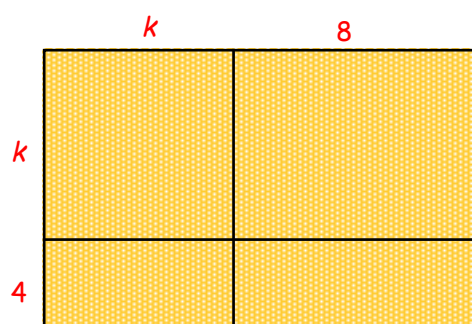
d



e



f



Removing Brackets (the distributive law)

Be able to expand out brackets

Examples :-

$$\begin{aligned} 1. \quad & 3(x+2) \\ & = 3x+6 \end{aligned}$$

$$\begin{aligned} 2. \quad & 2(4p-7q) \\ & = 8p-14q \end{aligned}$$

$$\begin{aligned} 3. \quad & a(a+8) \\ & = a^2+8a \end{aligned}$$

$$\begin{aligned} 4. \quad & 4m(5m-9n) \\ & = 20m^2-36mn \end{aligned}$$

$$\begin{aligned} 5. \quad & -2(q+5) \\ & = -2q-10 \end{aligned}$$

$$\begin{aligned} 6. \quad & -4(h-2) \\ & = -4h-4 \times (-2) \\ & = -4h+8 \end{aligned}$$

* note the Double Negative

Exercise 2



1. Multiply out the brackets :-

- | | | | | | | | |
|---|-----------|---|-----------|---|------------|---|-----------|
| a | $2(a+5)$ | b | $3(x+2)$ | c | $6(g+1)$ | d | $7(m+4)$ |
| e | $2(x-3)$ | f | $5(n-2)$ | g | $8(p-1)$ | h | $10(t-4)$ |
| i | $5(m-4)$ | j | $2(1-u)$ | k | $7(2-x)$ | l | $15(2+k)$ |
| m | $4(a+b)$ | n | $2(c+d)$ | o | $5(m-n)$ | p | $10(d-e)$ |
| q | $20(3+x)$ | r | $30(4-w)$ | s | $100(a-3)$ | t | $50(g-6)$ |

2. Remove the brackets :-

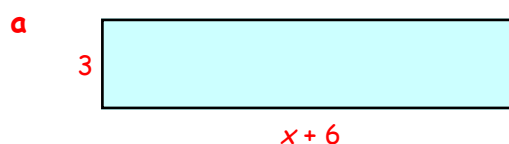
- | | | | | | | | |
|---|---------------|---|---------------|---|--------------|---|--------------|
| a | $2(3x+1)$ | b | $2(4a+3)$ | c | $3(1+5d)$ | d | $4(3-5k)$ |
| e | $7(7h-2)$ | f | $8(5-4n)$ | g | $6(5a+y)$ | h | $2(6t+2z)$ |
| i | $2(5b-4c)$ | j | $7(10k-2p)$ | k | $x(y+2)$ | l | $a(b-8)$ |
| m | $v(w-1)$ | n | $a(a-3)$ | o | $p(1-p)$ | p | $x(2+x)$ |
| q | $p(3q+r)$ | r | $5a(2-4a)$ | s | $2u(10u-y)$ | t | $2(3a+2b+1)$ |
| u | $5(2v+6w+8y)$ | v | $3(5x-2y-4z)$ | w | $10(p+q-4r)$ | x | $8(3u-5v-9)$ |



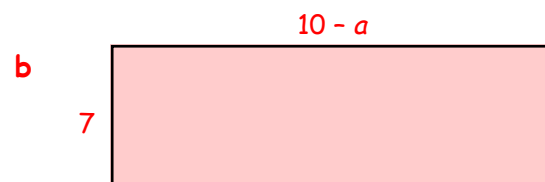
3. Rewrite the following without brackets :-

- | | | | | | | | |
|---|------------|---|--------------|---|-------------|---|---------------|
| a | $-3(x+1)$ | b | $-2(a-5)$ | c | $-(m+n)$ | d | $-(m-n)$ |
| e | $-6(p-q)$ | f | $-x(x+7)$ | g | $-p(1+p)$ | h | $-2w(w+9)$ |
| i | $-k(7k-1)$ | j | $-4e(2e+10)$ | k | $-x(3y-8x)$ | l | $-p^2(p-10q)$ |

4. Write the areas of these two rectangles :-
(All units are in centimetres).



(i) with brackets (ii) without brackets.



Removing Brackets and Simplifying

Be able to expand out brackets, then collect like terms

Examples :-

$$\begin{aligned} 1. \quad & 2(x+3) - 5 \\ & = 2x + 6 - 5 \\ & = 2x + 1 \end{aligned}$$

$$\begin{aligned} 2. \quad & 4(2p+5q) - 10q \\ & = 8p + 20q - 10q \\ & = 8p + 10q \end{aligned}$$

$$\begin{aligned} 3. \quad & 6(a+2) + 3(a-1) \\ & = 6a + 12 + 3a - 3 \\ & = 9a + 9 \end{aligned}$$

$$\begin{aligned} 4. \quad & 3(3p-4) - 2(p-6) \\ & = 9p - 12 - 2p + 12 \\ & = 7p \end{aligned}$$

note the Double Negative

$$\begin{aligned} 5. \quad & 21 - 3(x+6) \\ & = 21 - 3x - 18 \quad [\text{not } 18(x+6)] \\ & = 3 - 3x \end{aligned}$$

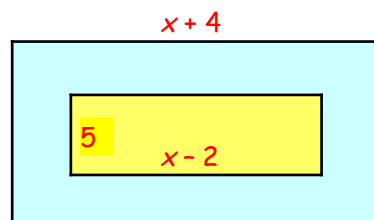
Exercise 3

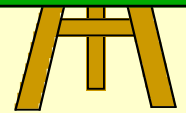
Multiply out the brackets and collect like terms :-



- | | | |
|----------------------|---------------------|----------------------|
| 1. a $2(x+1) + 4$ | b $3(a+5) + 2$ | c $5(p+3) - 8$ |
| d $6(w+1) - 6$ | e $2(k+1) + 8k$ | f $3(d+2) - 2d$ |
| g $10(2+g) - 8g$ | h $5x+5(x+4)$ | i $8a+4(a-2)$ |
| j $7q+5(3q-2)$ | k $4w+(w-1)$ | l $5a+4(a+6b)$ |
| m $m+2(7m+8q)$ | n $4x+2(8x-20y)$ | o $40p+6(10p+q)$ |
| p $1+3(x+1)$ | q $5(4a-2b)-20a$ | r $10w+10(9w+2z)$ |
| s $8+2(g-4)$ | t $12+7(m+2n)-11$ | u $6+2(e-2f)-6$ |
| 2. a $2(x+1)+3(x+2)$ | b $4(a+4)+5(a+1)$ | c $2(h-1)+5(h+1)$ |
| d $3(m-7)+6(m+4)$ | e $6(2+v)+5(1-v)$ | f $4(1-u)+5(1+u)$ |
| g $2(7e-3)+2(3e+5)$ | h $2(2-7x)+8(1+2x)$ | i $2(5b+4a)+2(6a-b)$ |
| 3. a $3(x+3)-2(x+2)$ | b $4(a+2)-3(a+2)$ | c $3(2p+4)-2(p+5)$ |
| d $7(2p+2)-10(p+1)$ | e $4(k+3)-2(k-3)$ | f $3(1+2m)-2(1-m)$ |
| g $10(2-d)-12(1-d)$ | h $h(h+4)-3(h-1)$ | i $a(3a-1)-2(2a-6)$ |
| 4. a $6-2(x+4)$ | b $4w-(w-1)$ | c $5-5(d-1)$ |
| d $10+5(2-h)$ | e $7-2(1-3m)$ | f $-2(g-1)-2$ |
| g $a-(20-a)$ | h $9t-3(t+6)+18$ | i $-3x-2(2-5x)$ |

5. By calculating the area of the large rectangle, then the area of the small rectangle, find the **blue border area** in terms of x .
(Answer in sq. units).





* your teacher
may show you an
alternative
method.

There are various ways of solving equations.

We are going to use the "change side - change sign" method *

Examples :-

$$\begin{aligned} 1. \quad x + 8 &= 13 \\ \Rightarrow x &= 13 - 8 \\ \Rightarrow x &= 5 \end{aligned}$$

move the + 8 to the other
side and change to -8.

$$\begin{aligned} 2. \quad 5p &= 30 \\ \Rightarrow p &= 30 \div 5 \\ \Rightarrow p &= 6 \end{aligned}$$

move the $\times 5$ to the other side
and change to $\div 5$

$$\begin{aligned} 3. \quad \frac{1}{4}a &= 3 \\ \Rightarrow 4 \times \frac{1}{4}a &= 4 \times 3 \\ \Rightarrow a &= 12 \end{aligned}$$

Multiply both sides by 4 to
eliminate the fraction.

$$\begin{aligned} 4. \quad 3m + 9 &= 30 \\ \Rightarrow 3m &= 30 - 9 \\ \Rightarrow 3m &= 21 \\ \Rightarrow m &= 7 \end{aligned}$$

Move the + 9 to the other side
and change to - 9.
move the $\times 3$ to the other side
and change to $\div 3$.

$$\begin{aligned} 5. \quad 2k - 7 &= 12 \\ \Rightarrow 2k &= 12 + 7 \\ \Rightarrow 2k &= 19 \\ \Rightarrow k &= 19 \div 2 = 9\frac{1}{2} \end{aligned}$$

Similar method to example 4.
Note that answers may contain
fractions.

Exercise 4



1. Copy each equation and solve it to find the value of the letter, as shown above :-

a $a + 6 = 8$

b $b + 11 = 16$

c $c - 3 = 4$

d $d - 10 = 10$

e $e - 40 = 30$

f $f + 4 = 3$

g $g - 6 = 0$

h $h + 9 = 0$

i $7 + x = 10$

j $9 + j = 1$

k $4 + k = 4$

l $25 + y = -25$

m $2m = 14$

n $5m = 35$

o $4u = 1$

p $3p = 20$

q $6q = 1$

r $10r = 25$.

2. Find the value of x in the following equations (Show each step of working carefully).

a $\frac{1}{2}x = 5$

b $\frac{1}{2}x = 3.5$

c $\frac{1}{3}x = 9$

d $\frac{1}{4}x = 1.5$

e $\frac{1}{5}x = 20$

f $\frac{3}{4}x = 3$.

g $3x + 1 = 7$

h $2x + 7 = 13$

i $4x + 3 = 35$

j $7x - 3 = 39$

k $9x - 1 = 89$

l $6x + 5 = 53$

m $2x - 10 = 46$

n $14x + 14 = 0$

o $2x - 9 = 0$

p $3x + 18 = 6$

q $6x + 5 = 20$

r $4x - 12 = 7$.



Equations with Brackets

Be able to
solve equations
with brackets



Examples :-

Multiply out
the brackets.

Move the + 10
to the other
side.

Divide by 2.

$$1. \quad 2(x + 5) = 18$$

$$\Rightarrow 2x + 10 = 18$$

$$\Rightarrow 2x = 18 - 10$$

$$\Rightarrow 2x = 8$$

$$\Rightarrow x = 4$$

$$2. \quad 3(3x - 5) = 48$$

$$\Rightarrow 9x - 15 = 48$$

$$\Rightarrow 9x = 48 + 15$$

$$\Rightarrow 9x = 63$$

$$\Rightarrow x = 7$$

Multiply out
the brackets.

Move the - 15
to the other
side.

Divide by 9.

Exercise 5



1. Solve the following equations by multiplying out the brackets first :-

a $2(x + 1) = 8$

b $3(x + 5) = 21$

c $5(x + 3) = 20$

d $4(x + 1) = 28$

e $6(x + 6) = 54$

f $2(x + 2) = 12$

g $10(x - 2) = 20$

h $9(x + 2) = 63$

i $2(x - 1) = 9$

j $5(x - 3) = 0$

k $4(x - 4) = 4$

l $3(x + 4) = 9$

m $2(3x + 1) = 14$

n $3(2x - 1) = 21$

o $4(5x - 2) = 12$

p $2(4x + 1) = 50$

q $3(2x - 9) = 0$

r $2(5x - 1) = 48$

s $2(x + 4) - x - 6 = 4$

t $3(x + 1) + 2x - 1 = 27$

u $4(x + 4) - 3x = 17$

v $5(x - 1) + 4x + 3 = 79$

w $7x + 5 + 3(x - 1) = 22$

x $4x + 2(x - 5) = 38$.

2. **A Mixture.** Solve :-

a $x + 9 = 21$

b $3x = 27$

c $\frac{1}{2}x = 8$

d $4x + 7 = 23$

e $2(x + 4) = 18$

f $6(x - 3) = 30$

g $x - 7 = 5$

h $14 + x = 19$

i $30x = 3000$

j $9x - 8 = 28$

k $5x + 22 = 2$

l $7 + x = 4$

m $3x = 1$

n $\frac{1}{5}x = 2 \cdot 2$

o $3x - 20 = 2$

p $2(3x + 8) = 28$

q $10 - x = 12$

r $20x = 10$

s $\frac{2}{3}x = 6$

t $2x + 9 = 6$

u $5(2x - 7) = 0$

v $\frac{1}{4}x + 1 = 6$

w $2(x + 6) - x - 1 = 13$

x $5(x + 2) - 2x = 22$

y $7(x + 1) + 2x - 1 = 15$

z $3(x - 3) + 2(x + 5) = 21$.



Evaluating Expressions and Formulae

Be able to
substitute
numbers for
letters

Examples :-

If $p = 3$, $q = 4$ and $r = -2$, find the values of :-

$$\begin{array}{lll} 1. & 7p & 2. & 4p + r & 3. & q^2 - p^2 \\ & = 7 \times 3 & & = 4 \times 3 + (-2) & & = (4 \times 4) - (3 \times 3) \\ & = 21 & & = 10 & & = 16 - 9 \\ & & & & & = 7 \end{array}$$

$$\begin{array}{ll} 4. & 2q^2 \\ & = 2 \times q \times q \\ & = 2 \times 4 \times 4 \\ & = 32 \end{array} \quad \begin{array}{ll} 5. & 5p^2 + 6q + 20r \\ & = (5 \times p \times p) + (6 \times q) + (20 \times r) \\ & = (5 \times 3 \times 3) + (6 \times 4) + (20 \times (-2)) \\ & = 45 + 24 - 40 = 29 \end{array}$$

6. If $C = \frac{a+b}{4}$,
find the value of C when
when $a = 10$ and $b = 18$.

$$\begin{aligned} C &= \frac{a+b}{4} \\ C &= \frac{10+18}{4} \\ C &= \frac{28}{4} = 7 \end{aligned}$$

Exercise 6

1. Find the value of each of the following when $a = 3$:-

a	$a + 6$	b	$a - 1$	c	$8a$	d	$5a - 19$
e	$2 + 4a$	f	$20 - 9a$	g	a^2	h	a^3
i	$a^2 - 9$	j	$2a^2$	k	$a^2 + a$	l	$a^2 - 1.2a$



2. Find the value of each of the following when $x = 4$:-

a	$5x$	b	$7x$	c	x^2	d	$2x^2$
e	x^3	f	$10x^2$	g	$20x^3$	h	$18 - x^2$

3. Find the values of each of the following :-

a	$g + 7$ when $g = 9$	b	$3h + 4$ when $h = -1$
c	$p - 9$ when $p = 25$	d	$12q - 30$ when $q = 3$
e	$15 - m$ when $m = -5$	f	$s + t$ when $s = -9$ and $t = 4$
g	$5ef$ when $e = 4$ and $f = -2$	h	$20 - 4ab$ when $a = 1$ and $b = -4$.



4. Given $p = 1$, $q = 3$ and $r = 7$, calculate the value of :-

a	$p + q + r$	b	$2p + 5q + r$	c	$q + p - 2r$
d	pqr	e	$5p + 5q + 10r$	f	$pq + qr + pr$
g	$3p + 2q - r$	h	$10pq - 4r$	i	$5pqr - 100$.

The Square Root :-

You now know what **squaring** a number does. It multiplies the number by itself. $5^2 = 5 \times 5 = 25$.

In reverse, what number, times itself, gives 25 ? $\Rightarrow$ The answer of course is **5** (since $5 \times 5 = 25$).

We say that **the square root** of 25 is 5 and use the symbol $\sqrt{\quad}$ $\sqrt{25} = 5$.

It reads as **the square root of 25 is 5**. Here are some **examples** :-

$$\sqrt{16} = 4 \text{ (since } 4 \times 4 = 16), \quad \sqrt{81} = 9, \quad \sqrt{1.44} = 1.2, \quad \sqrt{6^2 + 8^2} = \sqrt{36 + 64} = \sqrt{100} = 10$$

5. If $m = 3$ and $n = 4$, find the values of :-

a m^2	b $m^2 + n^2$	c $(n - m)^2$	$\sqrt{n}$
e $(n + m)^2$	f $2m^2$	g $\sqrt{3mn}$	$(m - 2)^2$
i $35 - 2n^2$	j $40 - 4m^2$	k $\sqrt{m^2 + n^2}$	l $(n^2 - m^2)^2$

6. If $x = 4$, $y = -2$ and $z = 1$, find :-

a $5x + y$	b $2y + 5z$	c y^2
d $10 + 8z^2$	e $2x^2 + 3y^2$	f $z^2 + y^2$
g $5x^2 + 10y - z$	h $4y^2 - 3x - z$	i $2z^2 + 4y^2 - 3x$

7. Given $a = 2$, $b = 8$, $c = 10$ and $d = -4$, find :-

a $\frac{1}{2}a$	b $\frac{1}{4}b$	c $\frac{2}{5}c$
d $\frac{1}{5}(a + b)$	e $\frac{1}{3}(c + d)$	f $\frac{1}{7}(c - d)$
g $\frac{1}{4}(b - d)$	h $\sqrt{\frac{b + c}{2}}$	i $2c^2 - 25d$

8. In each of the following formulae, find the value of the letter for which you are asked :-

a $P = q - r$	find P ,	when $q = 9.5$ and $r = 2.5$.
b $D = S \times T$	find D ,	when $S = 60$ and $T = 1.5$.
c $W = G \times H$	find W ,	when $G = 25$ and $H = 6$.
d $V = Ah$	find V ,	when $A = 40$ and $h = 2.5$.
e $C = ab$	find C ,	when $a = 2.6$ and $b = 20$.
f $D = e \times f \times g$	find D ,	when $e = 100$, $f = 5$ and $g = 0.5$.
g $T = 2m + 2n$	find T ,	when $m = 3.5$ and $n = 7.5$.
h $N = z - 100v$	find N ,	when $z = 500$ and $v = 4.4$.
i $A = \frac{b}{c}$	find A ,	when $b = 1200$ and $c = 40$.
j $G = \sqrt{z - 9v}$	find G ,	when $z = 100$ and $v = 4$.
k $J = \frac{h - g}{k}$	find J ,	when $h = 26$, $g = -4$ and $k = 3$.

$$\begin{aligned} P &= q - r \\ P &= 9.5 - 2.5 \\ P &= \dots \end{aligned}$$



Examples :-

1. Julie is withdrawing money from an ATM.
She withdraws x lots of £5 notes and y lots of £10 notes.

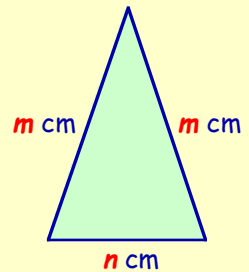
- a Write down a formula in terms of x and y for W , the total amount she withdraws.
b When $x = 4$ and $y = 3$, find the actual amount withdrawn.

$$\begin{aligned} \text{a } W &= 5x + 10y & \text{b } W &= 5x + 10y \\ & & &= 5 \times 4 + 10 \times 3 \\ & & &= 50 \\ & & &\text{£50 withdrawn.} \end{aligned}$$



2. An **isosceles** triangle is shown opposite.

- a Write a formula for its perimeter, P , in terms of m and n .
b Calculate its perimeter when $m = 8.5$ and $n = 5$.
c Find n when $P = 52$ and $m = 20$.



$$\begin{aligned} \text{a } P &= 2m + n & \text{b } P &= 2m + n & \text{c } P &= 2m + n \\ & & &= 2 \times 8.5 + 5 & &52 = 40 + n \\ & & &= 22 & &n = 12 \\ & & &\text{Perimeter} = 22 \text{ cm.} & & \end{aligned}$$



Exercise 7

1. A truck weighs x tonnes when empty. If rocks weighing y tonnes are lifted, its loaded weight becomes W tonnes.

- a Write a formula for W , in terms of x and y .
b Find W when $x = 2.75$ and $y = 2.25$.
c Calculate y when $W = 9$ and $x = 6.5$.



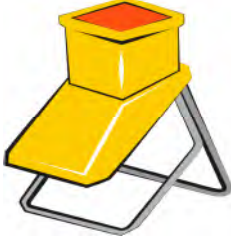
2. A plank of wood is m metres long. When n metres have been sawn off, the remaining length is L metres.



- a Write a formula for L , in terms of m and n .
b Find L when $m = 3.75$ and $n = 1.5$.
c Calculate m when $L = 10$ and $n = 2.75$.

3. "To find the average speed (S mph) for a journey travelled, divide the distance travelled (D miles) by the time taken (T hrs)."
- Write a formula for S , in terms of D and T .
 - Find S when $D = 180$ and $T = 3$.
 - Calculate the distance travelled at that speed for $5\frac{1}{2}$ hours.



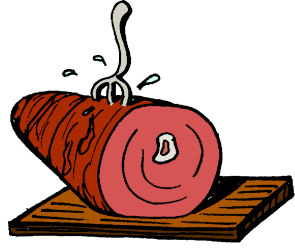
4.  The cost C of hiring a shredder from a garden store is £ k per day, plus a payment of £10.

- Write a formula for C , in terms of k , when hiring for 5 days.
- Find C when $k = 6$.

5. To change from degrees Celsius ($^{\circ}C$) to degrees Fahrenheit ($^{\circ}F$) use the following formula :-
 "Multiply the temperature in $^{\circ}C$ by 1.8, then add 32 to the answer".

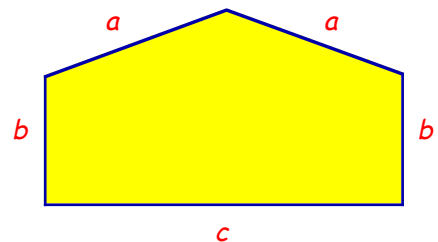
- Write a formula for changing from C to F . $F = \dots \times \dots + \dots$
- Use your formula to change $30^{\circ}C$ into degrees Fahrenheit.

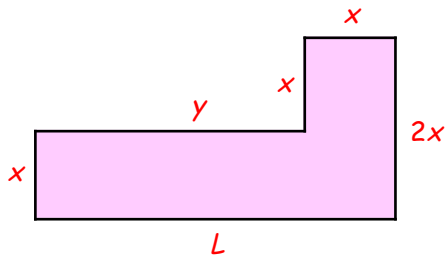


6.  The recommended time, (T) minutes, to cook a ham joint in the oven is g minutes **per pound**, then add an extra h minutes at the end.

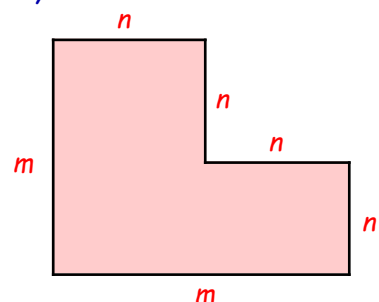
- Write a formula for T , in terms of g and h showing the time needed to cook a 10 pound joint of ham.
- Find T when $g = 20$ and $h = 15$.

7.
 - Write down a formula, in terms of a , b and c , for finding the perimeter P of this shape.
 - Find P when $a = 5$, $b = 4$ and $c = 8$.
 - Calculate c when $P = 50$, $a = 10$ and $b = 7$.



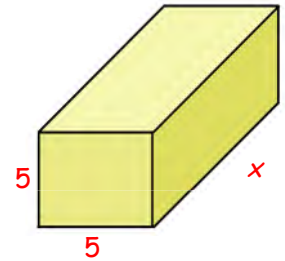
8. 
 - Write down the length of the L side in terms of x and y .
 - Write down a formula, in terms of x and y , for finding the perimeter P of this shape.
 - Find P when $x = 3$ and $y = 10$.

9.
 - Write down a formula, in terms of m and n , for finding the perimeter P of this shape.
 - Find P when $m = 8$ and $n = 4$.
 - Calculate n when $P = 40$ and $m = 10$.



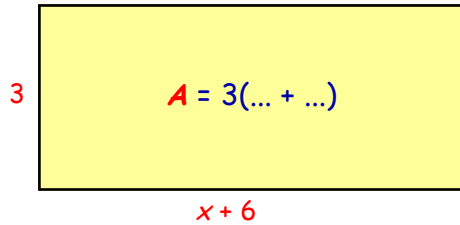
10. The cuboid shown has length x cm, breadth 5 cm and height 5 cm.

- Find a formula for the sum S cm of the lengths of **all** its edges.
- Calculate S if $x = 20$.

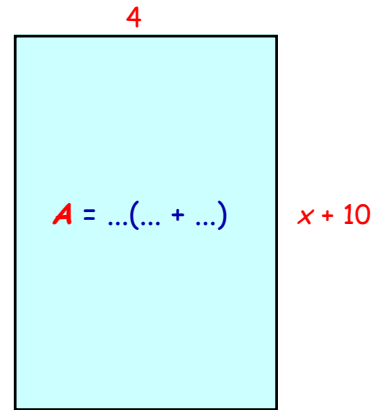


11. a For each of the rectangles below, use brackets to write a formula for its **area** (A).

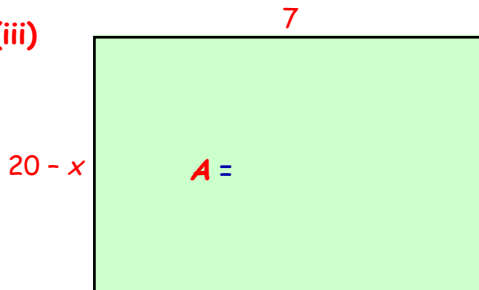
(i)



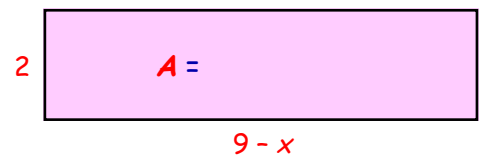
(ii)



(iii)



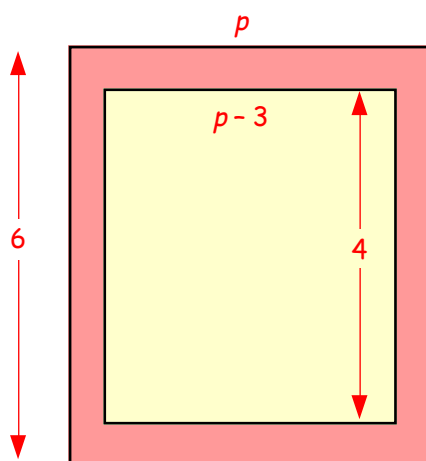
(iv)



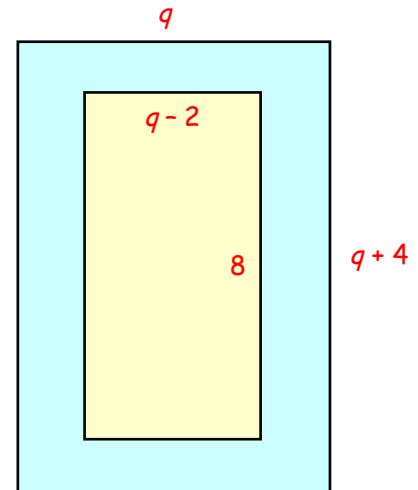
- Multiply out each of the brackets.
- Find the area each time, if $x = 5$.

12. a Write down a formula, in terms of p or q , for the area A of each **large** rectangle below.

(i)



(ii)



- Now write a formula, in terms of p or q , for the area A of each **small yellow** rectangle.
- Determine a formula for the red area and a formula for the blue area.
- Calculate the red area and the blue area (in sq. units) when $p = 4$ and $q = 6$.

The 3 Я's

Revisit - Review - Revise



1. Simplify the following expressions :-

a $m + m$

b $g \times g$

c $12a \times b$

d $3v \times 9w$

e $8x + 4y - x - 7y$

f $h \times h \times h$

g $a^2 \times 6a$

h $9e \times 8e^2$

i $7p + q - 6p - 11q$

j $12a^2 \div 2a$

k $80x^2 \div 10x$

l $54u^2 \div 9u$

2. Work out the value of these expressions when $a = 4$, $b = 3$ and $c = -2$:-

a $5a + b$

b $6b - a$

c $a^2 + c^2$

d abc

e $(b - c)^2$

f $3a^2$

g $\sqrt{a}$

h $\frac{c - a}{b}$

i $\frac{3a}{bc}$

j $\frac{ab^2}{c^2}$

k $\sqrt{3a - 2c}$

l $\sqrt{a^2 + 6b - c}$

* (Remember $\sqrt{16} = 4$ as $4 \times 4 = 16$, $\sqrt{100} = 10$ as $10 \times 10 = 100$).

3. Multiply out the brackets :-

a $3(2x + 5)$

b $8(5p - 3q)$

c $h(h + 7)$

d $9m(2m - 3n)$

e $-10(g - 4)$

f $-x(x - 5y)$

g $-3a(6 - a)$

h $-e^2(e - 9f)$

4. Expand the brackets and then **simplify** :-

a $6(m + 2) - 10$

b $7a + 3(a - 4)$

c $4 + 5(p - 1)$

d $18 + 2(2x - 9)$

e $4(k + 2) + 2(k - 3)$

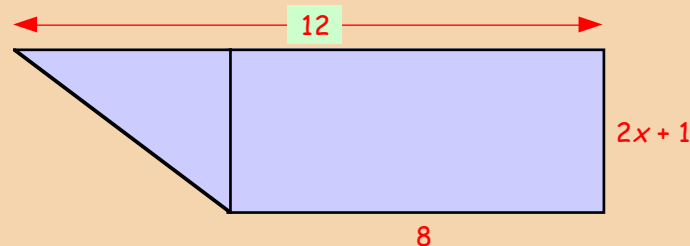
f $7(w - 1) + 6(w + 2)$

g $2(3t - 1) - 5(t - 1)$

h $10(5n - 3) - 4(10n - 10)$

i $3g - (4 - g)$

5. This shape is made up of a rectangle and a right angled triangle.



Write down an expression for the **total area** of the shape, in terms of x .

6. For each of the following formula, work out the value of the capital letter :-

a $M = c + d$ Find M , when $c = 2.5$ and $d = 1.75$.

b $T = \frac{pq}{r}$ Find T , when $p = 6$, $q = 15$ and $r = 9$.

c $W = \sqrt{efg}$ Find W , when $e = 1$, $f = 2.5$ and $g = 10$.

d $G = 3m^2 - n$ Find G , when $m = -2$ and $n = 12$.

Remember what $\sqrt{\quad}$ means ?

7. To change a number of kilometres into miles :-

Multiply the kilometres by five, then divide your answer by eight.

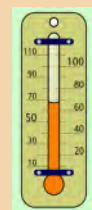
Change 320 kilometres into miles.

SEASIDE HIGHWAY	
Sandy Beach	5
Bill's Lagoon	9
Sandstone Cliffs	22
Golden Blue Beach	45

8. To change from degrees Celsius ($^{\circ}\text{C}$) to degrees Fahrenheit ($^{\circ}\text{F}$) :-

Multiply by 1.8 and add 32.

Change 20°C to $^{\circ}\text{F}$.



9. The cost of hiring a jet ski for a number of hours is given by the formula :-

$C = F + 10H$

where C is the total cost (in £'s)

F is a fixed value and

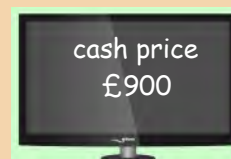
H is the cost per hour.



Find the total cost of hiring a jet ski for 3 hours with a fixed value of £20.

10. To find the hire purchase price of buying an HD TV :-

Pay a deposit of $\frac{1}{5}$ of the cash price and pay 10 payments of £83.

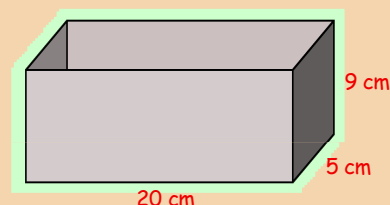


a Calculate the hire purchase price.

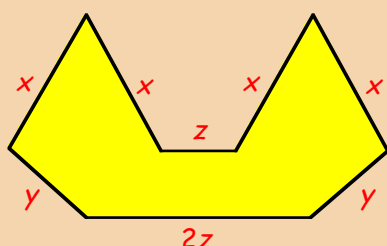
b How much dearer is it compared to the cash price ?

11. a Write down the formula for the **volume** of a cuboid.

b Calculate the **volume** of this cuboid.



12.



a Construct a formula for finding P , the **perimeter** of the shape shown opposite. (Units are in cm.)

b Find P , when $x = 8$, $y = 6$ and $z = 5$.

c Find z , when $P = 136$, $x = 20$ and $y = 10$.

CHAPTER 8

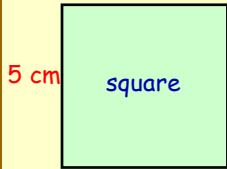
Perimeter/Area

Perimeter/Area of a Square, Rectangle, Triangle

Revision

Be able to use formulae to find perimeter/area of a square, rectangle, triangle

Examples :- Calculate the **perimeter** and **area** of each of these shapes :-



5 cm

$$\begin{aligned}\text{Perimeter} &= 5 + 5 + 5 + 5 \\ &= 25 \text{ cm}\end{aligned}$$

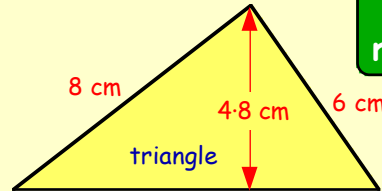
$$\begin{aligned}\text{Area} &= L \times L \\ &= 5 \times 5 \\ &= 25 \text{ cm}^2\end{aligned}$$



8 cm

$$\begin{aligned}\text{Perimeter} &= 3 + 8 + 3 + 8 \\ &= 22 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Area} &= L \times B \\ &= 3 \times 8 \\ &= 24 \text{ cm}^2\end{aligned}$$



10 cm

$$\begin{aligned}\text{Perimeter} &= 10 + 8 + 6 \\ &= 24 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Area} &= \frac{1}{2} \times B \times H \\ &= 0.5 \times 10 \times 4.8 \\ &= 24 \text{ cm}^2\end{aligned}$$

If the length and breadth are in cm $\Rightarrow$ Area is in cm^2

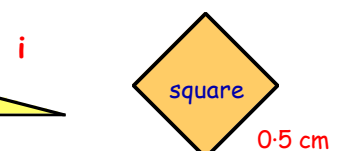
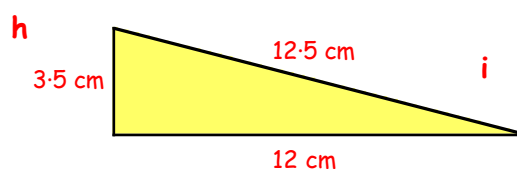
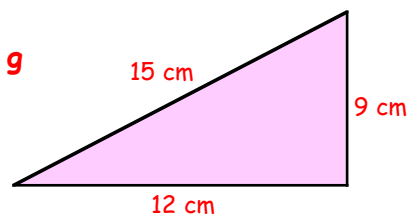
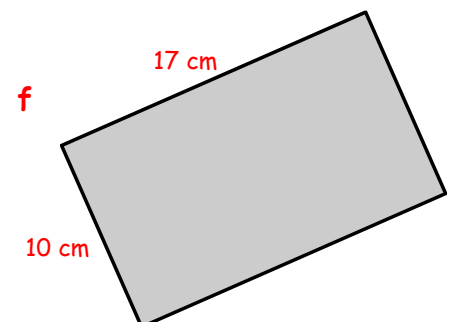
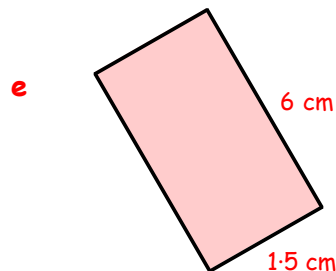
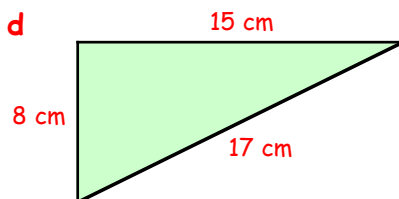
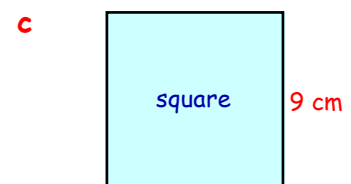
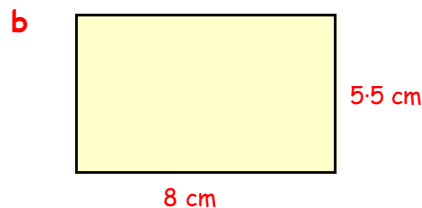
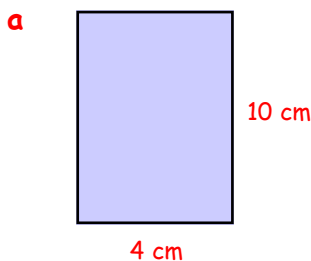
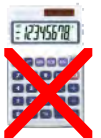
If the length and breadth are in mm $\Rightarrow$ Area is in mm^2

If the length and breadth are in m $\Rightarrow$ Area is in m^2

* the area of a triangle can also be calculated by finding *half the surrounding rectangle*

Exercise 1

1. Calculate :- (i) the perimeter (ii) the area of each of these shapes :-



2. Calculate the areas of the objects shown below, using an appropriate formula :-

a



Sponge Bob's Square Head
side 9 cm

b



Kiltie Photo

200 mm

120 mm

c

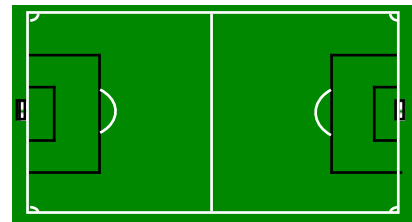


Union Jack

2 m

2.5 m

d



30 m

7-a-side football pitch

18 m

e



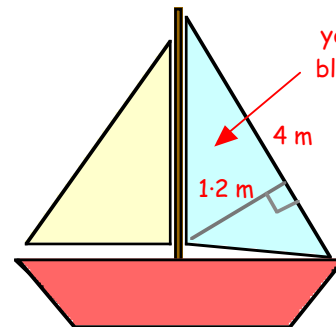
triangular mayo sandwich

14.5 cm

find the area of this face.

10 cm

f



yacht's blue sail

4 m

1.2 m

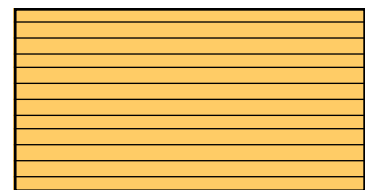
3. Donnie decides to varnish his Youth Club Hall floor.

a Calculate the **area** of the floor.

b A litre of varnish covers 17 m^2 .

How many litres will be needed for one coat of varnish ?

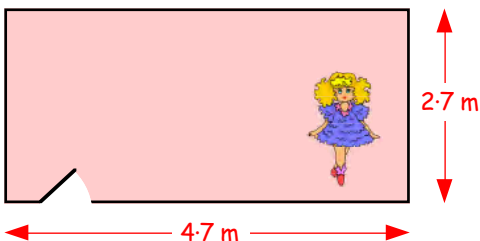
c If a litre tin costs £6.50, what will it cost to cover the floor with **two** coats of varnish ?



8.5 m

20 m

4.



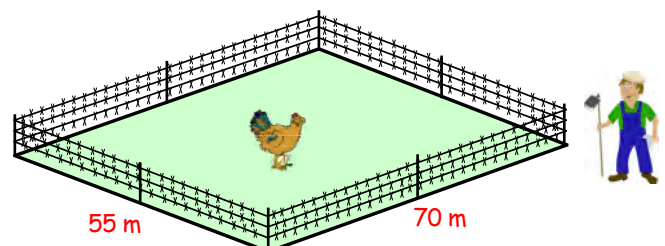
The diagram shows the carpeted floor of Mandy's bedroom.

a Calculate the perimeter of the floor.

b How much will it cost to surround it with new skirting board costing £2.50 per metre ?

(The door is 0.80 metre wide).

5. Farmer McDougall owns a rectangular field.
He surrounds it with 3 strands of barbed wire.
The wire costs 80p per metre.
Calculate the total cost of the wire.



55 m

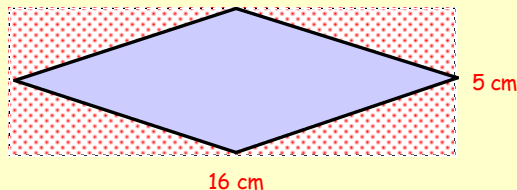
70 m

The Area of a Rhombus and a Kite

Be able to use formulae to find the area of a rhombus & a kite

Area of a Rhombus

Draw (or imagine) the rectangle that neatly surrounds the rhombus.



The rhombus shown above has length 16 cm and height 5 cm.

Its **Area** is calculated by finding the area of the surrounding rectangle and then **halving** the answer found.

$$\text{Area Rect.} = L \times B = 16 \times 5 = 80 \text{ cm}^2.$$

$$\text{Area Rhombus} = \frac{1}{2} \text{ of } 80 \text{ cm}^2 = 40 \text{ cm}^2.$$

Note that the length and breadth of a rhombus are actually the measurements of its **diagonals**.

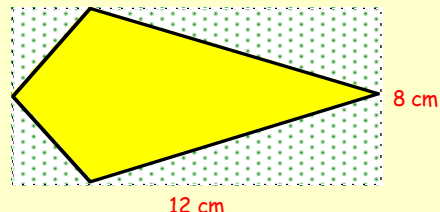
$$\text{Area of Rhombus} = \frac{1}{2} \text{ diagonal} \times \text{diagonal}$$

$$\text{or Area} = \frac{1}{2} (D \times d)$$

(where D and d are lengths of big and small diagonals).

Area of a Kite

Found in the same way as the Rhombus.



$$\text{Area Rect.} = L \times B = 12 \times 8 = 96 \text{ cm}^2.$$

$$\text{Area Kite} = \frac{1}{2} \text{ of } 96 \text{ cm}^2 = 48 \text{ cm}^2.$$

OR

$$\text{Area Kite} = \frac{1}{2} \text{ diagonal} \times \text{diagonal}$$

$$= \frac{1}{2} \times 12 \times 8$$

$$= 48 \text{ cm}^2.$$

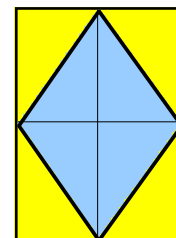
$$\text{Area of Kite} = \frac{1}{2} \text{ diagonal} \times \text{diagonal}$$

$$\text{or Area} = \frac{1}{2} (D \times d)$$

(where D and d are lengths of big and small diagonals).

Exercise 2

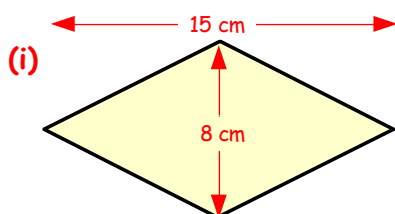
1.
 - a Make an accurate drawing of a rhombus with diagonals measuring 6 cm by 8 cm. (Draw the 2 diagonals 6 cm by 8 cm meeting at right angles in the middle.)
 - b On your diagram, draw a rectangle neatly around the rhombus.
 - c Calculate the area of the rectangle.
 - d Now calculate the area of the rhombus.



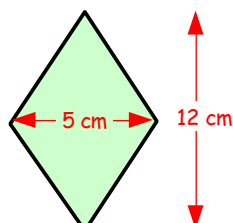
2. Sketch each rhombus below and surround it with a rectangle.

- a Calculate the area of the rectangle.

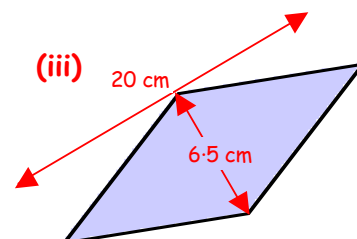
- b Calculate the area of the rhombus.



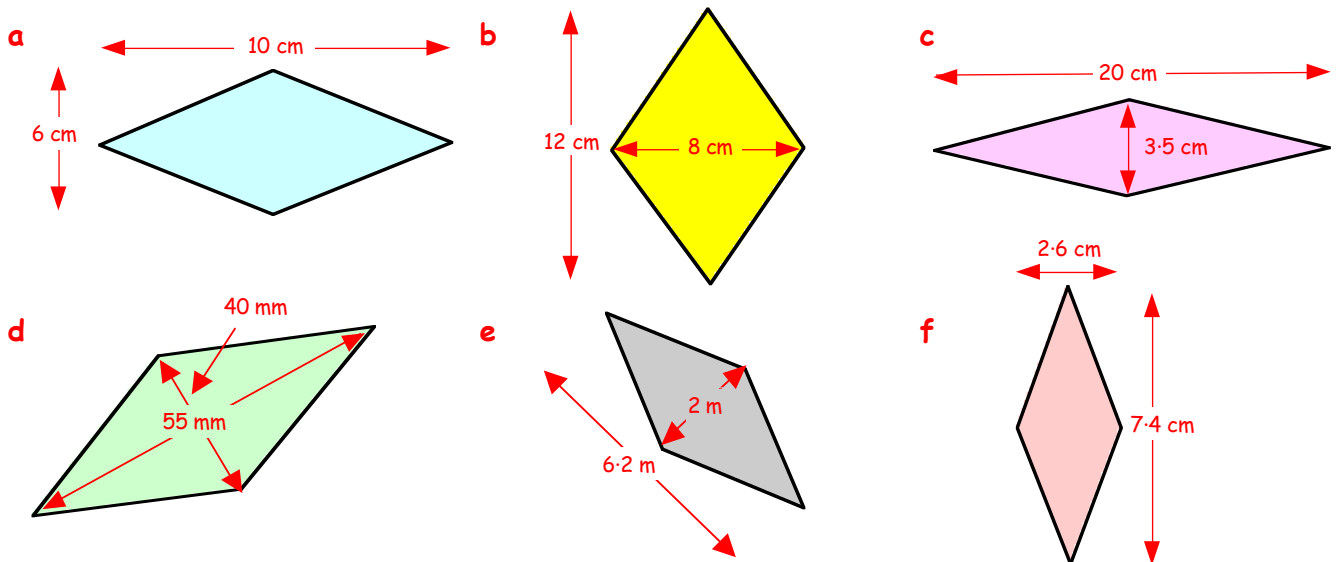
(ii)



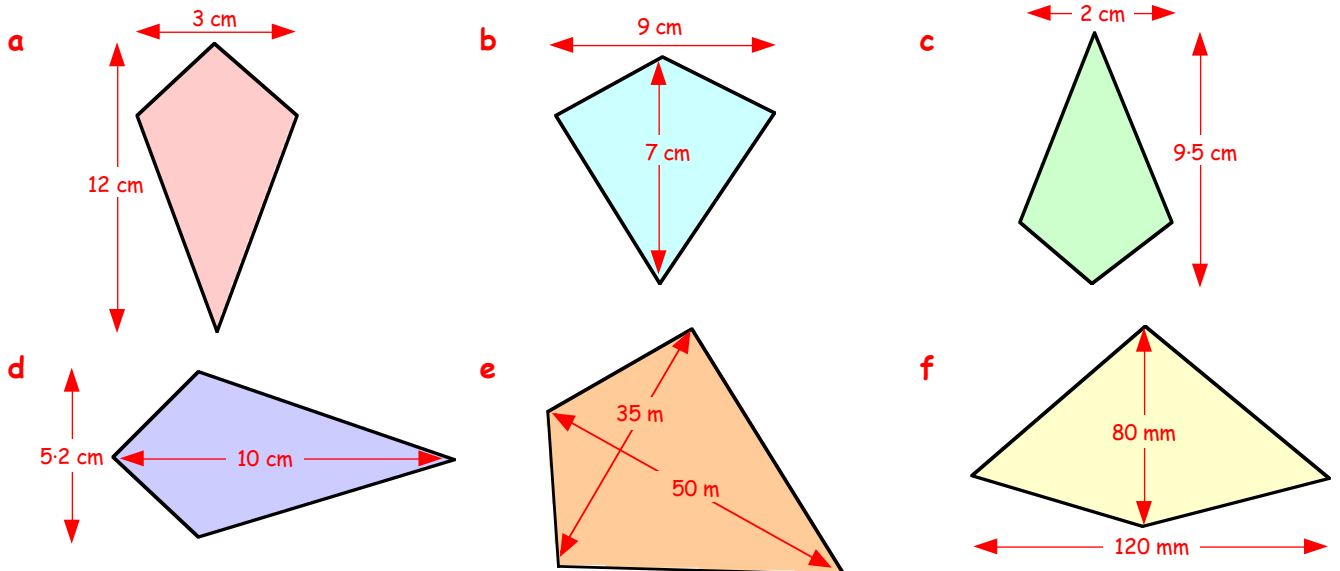
(iii)



3. Use the formula "**Area of Rhombus** = $\frac{1}{2}(D \times d)$ " to find the areas of these rhombi :-



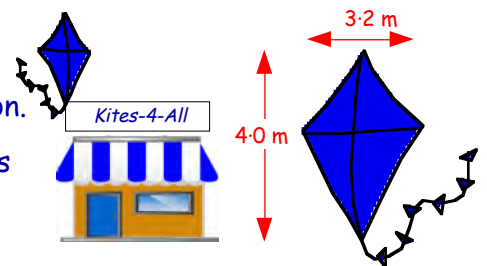
4. Use the formula "**Area of Kite** = $\frac{1}{2}(D \times d)$ " to find the areas of these kites :-



5. "Kites - 4 - All" fly a giant kite above their new store in Hillington.

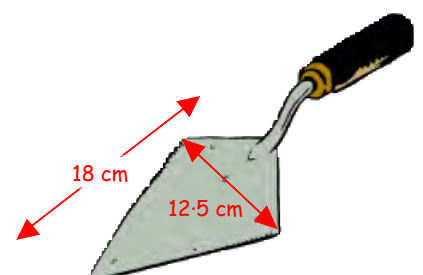
The kite is strengthened by 2 plastic poles measuring 3.2 metres and 4 metres which are fitted as diagonals of the feature.

Calculate the **area** of their giant kite.



6.  Local fishermen used to nickname this fish "The Rhombus". Find the approximate **area** of its body if its measurements are 30 cm long and 12 cm in height.

7. The base of this trowel is in the shape of a kite. Find its **area** of its top surface.



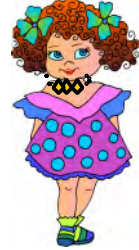
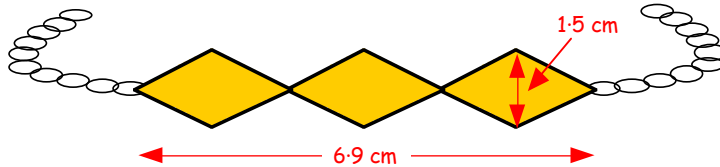
8. Simon bought a pair of cufflinks, each one in the shape of a rhombus.

The diagonals of each rhombus are 0.9 centimetres and 1.4 centimetres.

Calculate the total **area** taken up by the 2 faces of rhombi.



9. Debbie's necklace is made up of 3 identical golden rhombi on a chain.

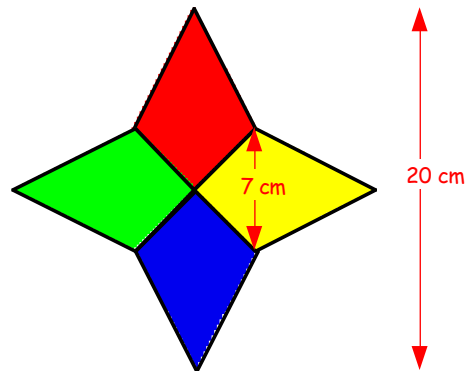


The 3 rhombi together measure 6.9 centimetres long and each has a height of 1.5 centimetres.

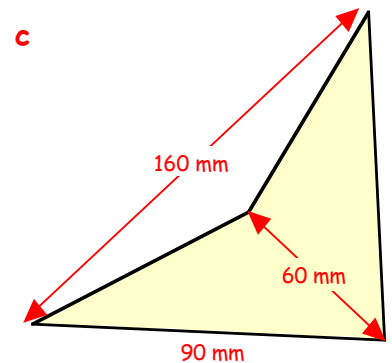
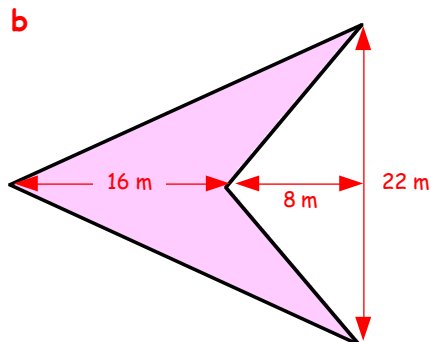
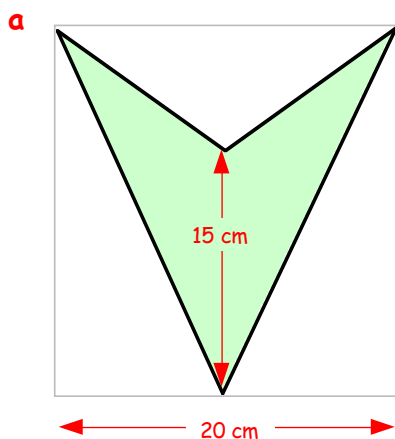
Calculate :-

- the length of the diagonal of one of the rhombi.
- the **total area** of the 3 golden rhombi.

10. Calculate the **area** of the star-shape, constructed from 4 identical kites.



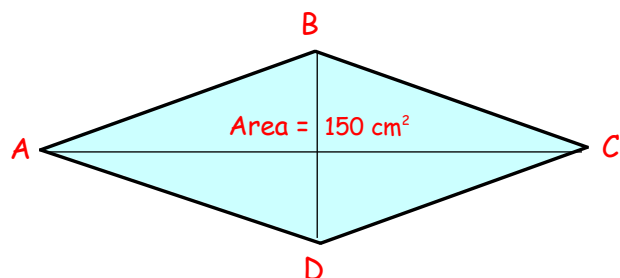
11. Calculate the **area** of each V-kite.



12. The **area** of rhombus ABCD is 150 cm^2 .

The length of diagonal AC is 30 cm.

Work out the length of diagonal BD.

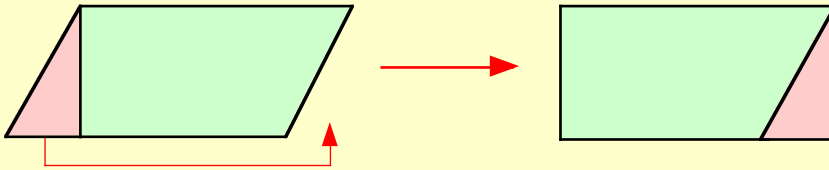


The Area of a Parallelogram

Be able to use formulae to find the area of a parallelogram

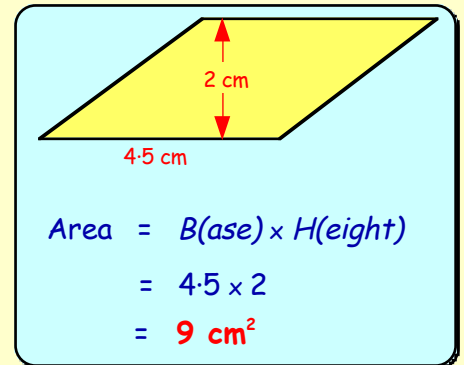
It should be easy to see why

the area of a parallelogram = the area of a rectangle.



Remember :- (Area of Rectangle = Length x Breadth)

Example :-

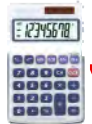
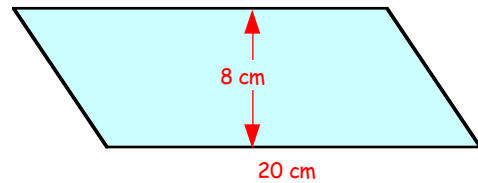


A difference in notation :-

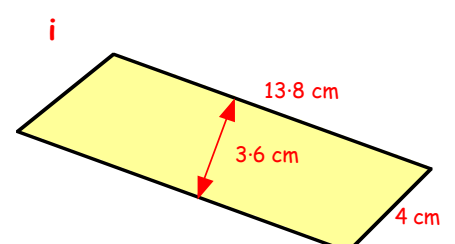
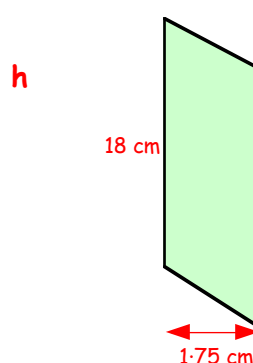
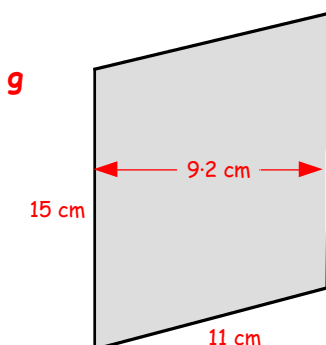
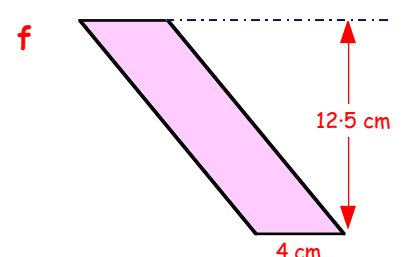
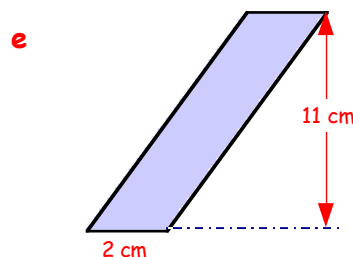
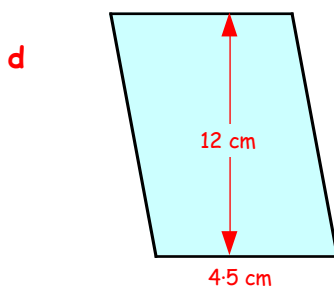
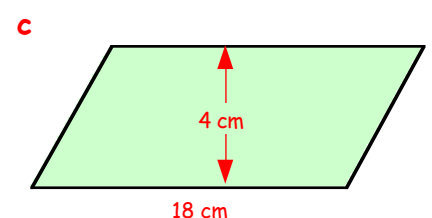
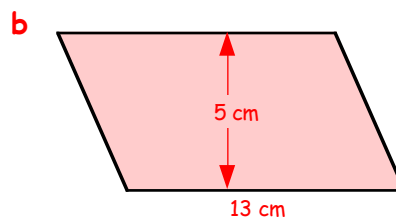
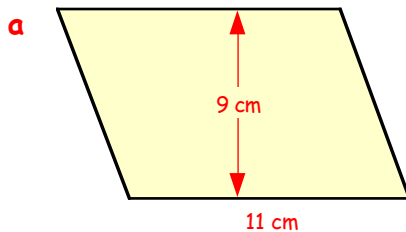
AREA of Parallelogram = Base $\times$ Height

Exercise 3

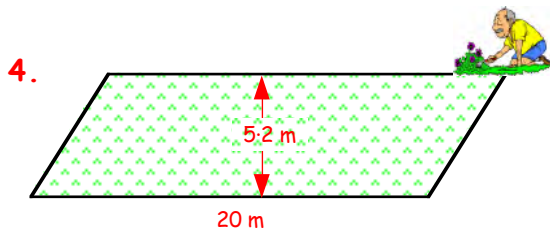
- This is a sketch of a parallelogram.
Use the formula **Area = $B \times H$** to find its area.



- Calculate the **area** of each parallelogram :-

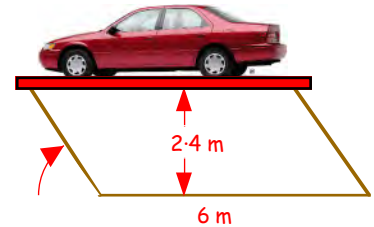


3. This light switch is in the shape of a parallelogram.
Calculate its **area**.

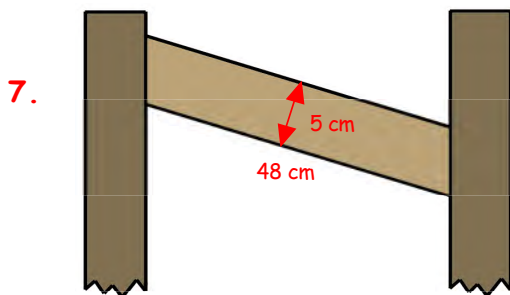
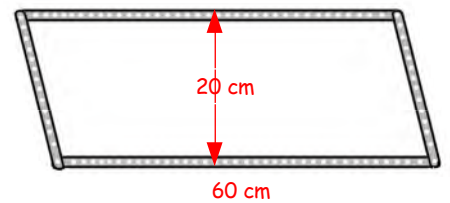


- Mr Ainslie has a lawn in the shape of a parallelogram.
Calculate the **area** of his lawn.

5. The ramp in this garage is the shape of a parallelogram.
Calculate the **area** of the gap shown.

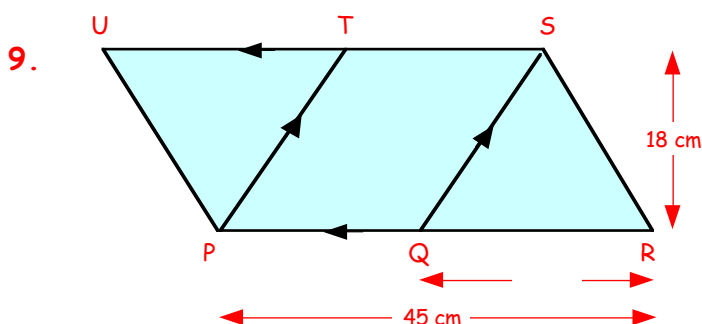
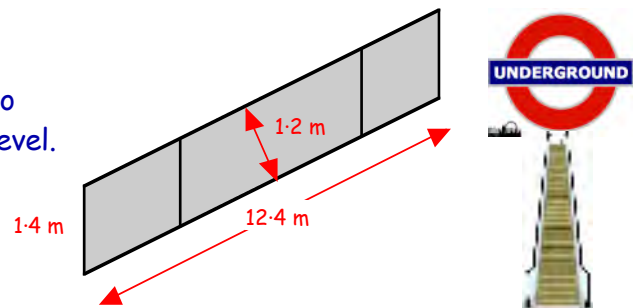


6. 4 Mechano Strips are joined to make a parallelogram shape.
Calculate the **area** of the shape formed.



- A sloping wooden plank is used to help strengthen 2 upright posts.
Calculate the **area** of the sloping plank.

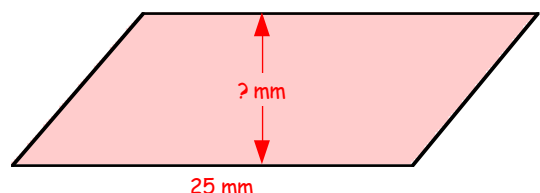
8. Movable stairways are used on the London Tube to take passengers from below ground up to street level.
Again, parallelogram shapes are noticeable.
Find the **area** of the large parallelogram.



Look at the diagram opposite.

- Use four letters each time to name 2 parallelograms.
- Calculate the **area** of each parallelogram.

10. The **area** of this parallelogram is 375 mm^2 .
Calculate its height.



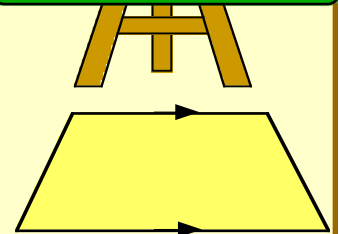
The Area of a Trapezium

A **Trapezium** is a 4-sided figure (Quadrilateral) with 2 sides parallel.

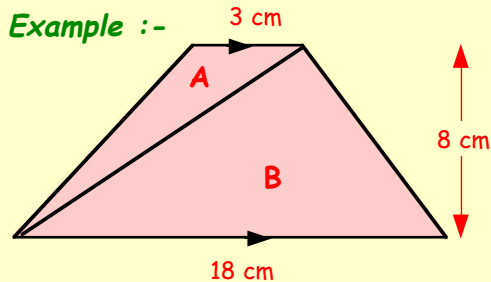
The **Area** of a **Trapezium** is found by :-

- drawing in one of its diagonal lines, splitting the figure into 2 triangles,
- working out the area of each triangle,
- adding the 2 triangular areas together.

Be able to find the area of a trapezium by making 2 triangles



A TRAPEZIUM



$$\text{Area } \triangle A = \frac{1}{2} \times B \times H = \frac{1}{2} \times 3 \times 8 = 12 \text{ cm}^2$$

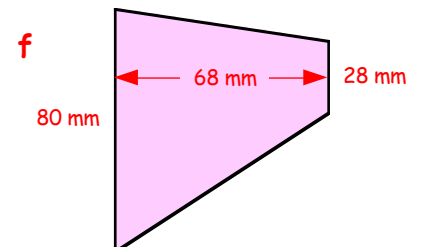
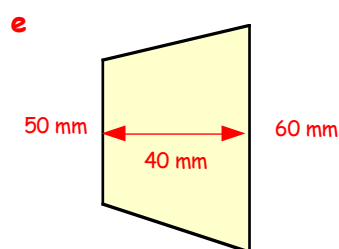
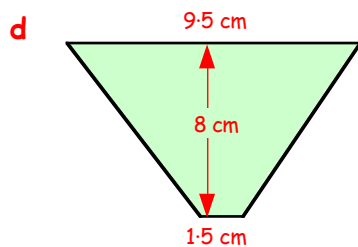
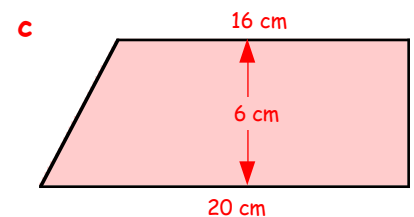
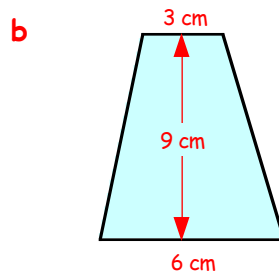
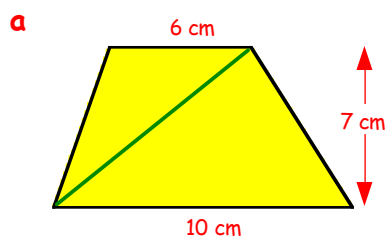
$$\text{Area } \triangle B = \frac{1}{2} \times B \times H = \frac{1}{2} \times 18 \times 8 = 72 \text{ cm}^2$$

$$\text{Total Area} = 12 \text{ cm}^2 + 72 \text{ cm}^2 = 84 \text{ cm}^2$$

Exercise 4

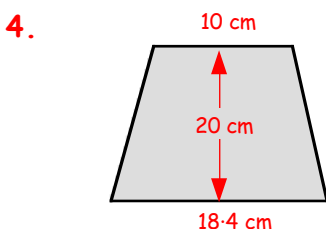
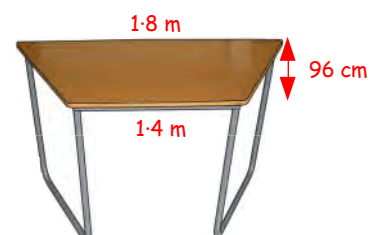


1. For each of the following, sketch and split each trapezium into 2 triangles and find its **area** :-

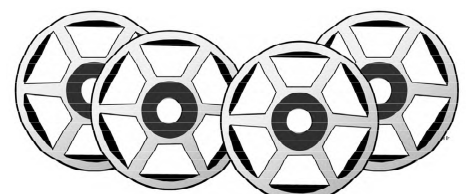


Calculate the area of this Malaysian stamp.

3. The top of this table in the school library is a trapezium. Find its area in **cm**².



Joe has alloy wheels on his car.
Each gap is trapezium shaped.
Calculate the **total area** taken up by the **6 gaps** in one wheel.



Composite Areas

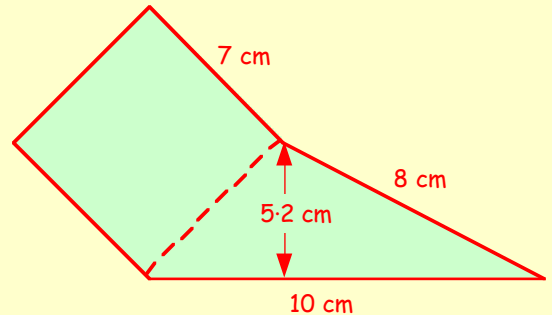
Be able to calculate the area of a figure made up of 2 or more shapes

We now look at examples which combine the areas which we have studied in this chapter.

Example :-

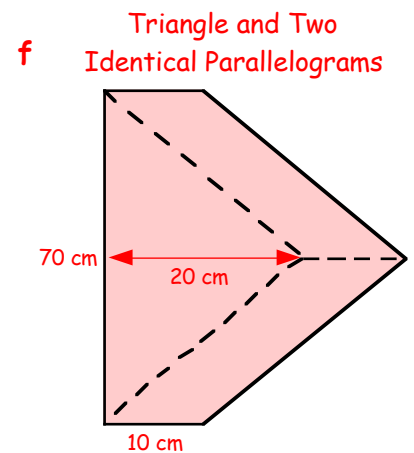
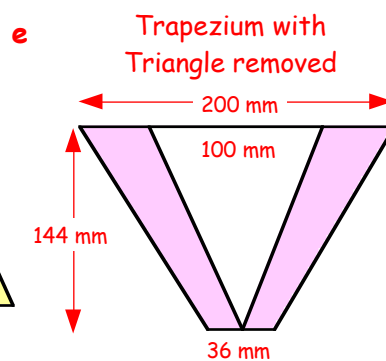
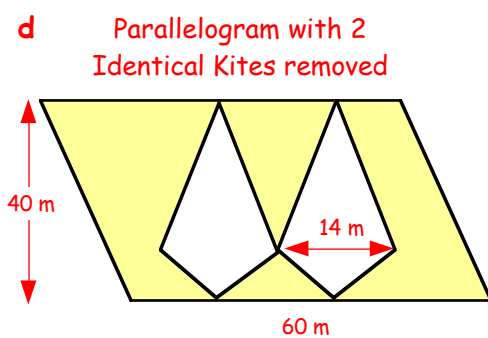
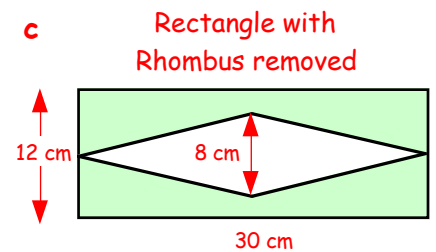
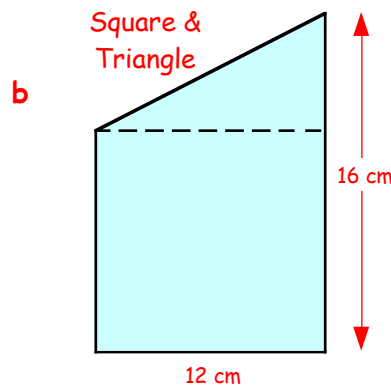
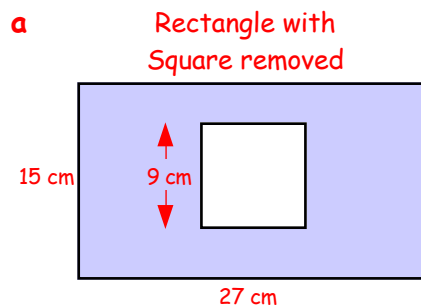
Calculate the area of this **composite** shape consisting of a triangle with a square along one side.

$$\begin{aligned}
 \text{Area Square} &= L \times L & \text{Area Triangle} &= \frac{1}{2} B \times H \\
 &= 7 \times 7 & &= \frac{1}{2} \text{ of } 10 \times 5.2 \\
 &= 49 \text{ cm}^2 & &= 26 \text{ cm}^2 \\
 \text{TOTAL} &= 75 \text{ cm}^2
 \end{aligned}$$

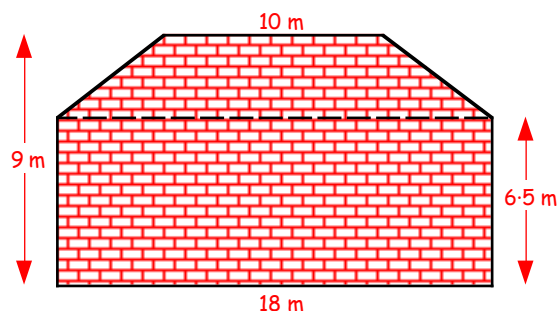


Exercise 5

1. Calculate the shaded areas :-



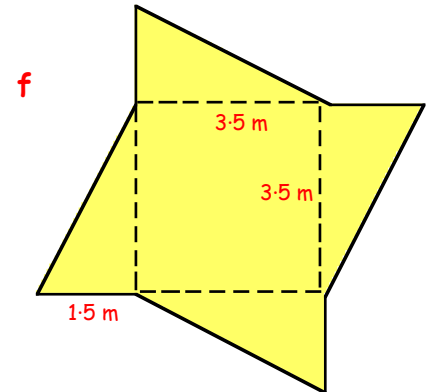
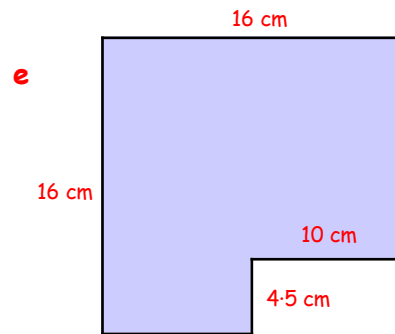
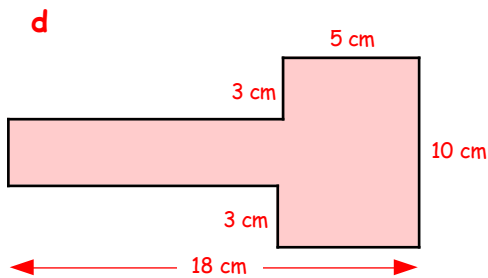
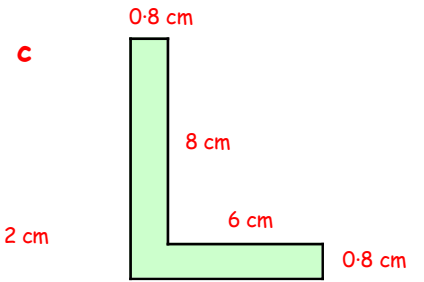
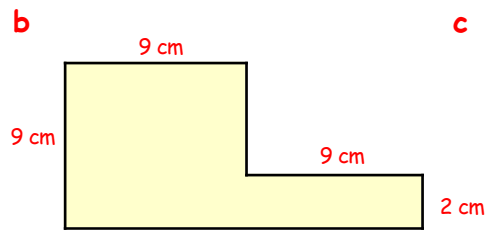
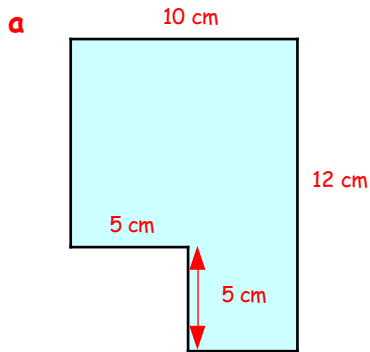
2.



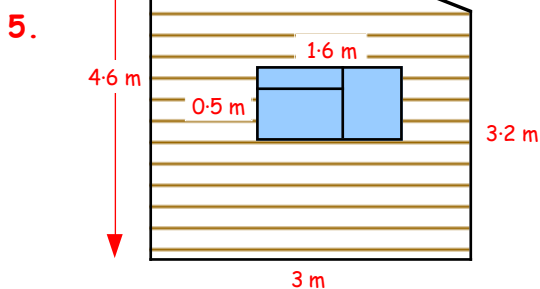
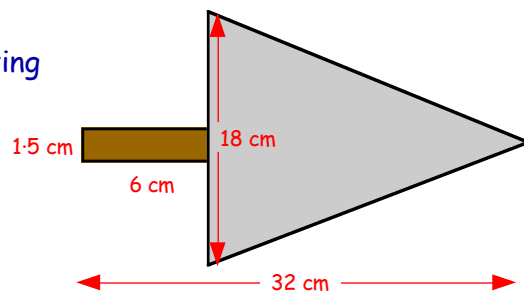
Find the area of this house shape.

The house is rectangular and has a "trapezium" roof.

3. Calculate these **areas** :-

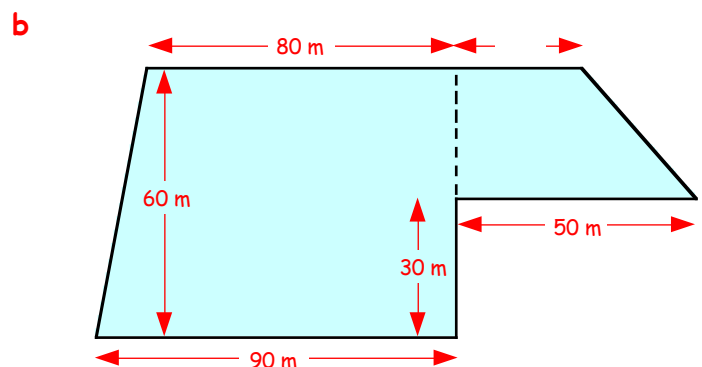
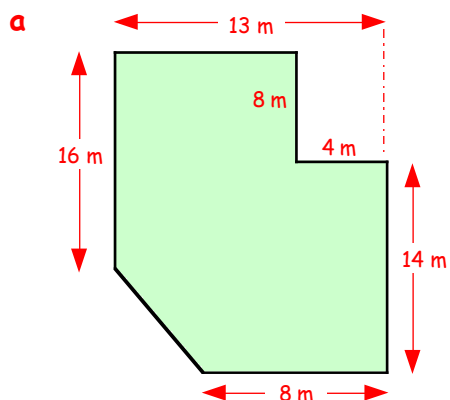


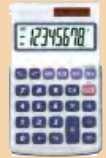
4. Calculate the **area** of this arrow head, consisting of a triangle and a rectangle :-



Calculate the **wooden area** of the side of this hut.
The dimensions of the window are 0.5 m by 1.6 m.

6. Calculate the **area** of these **composite** shapes :-



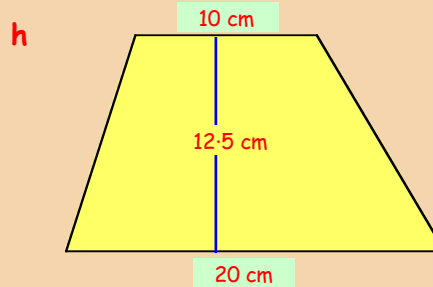
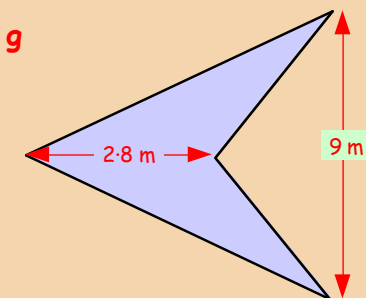
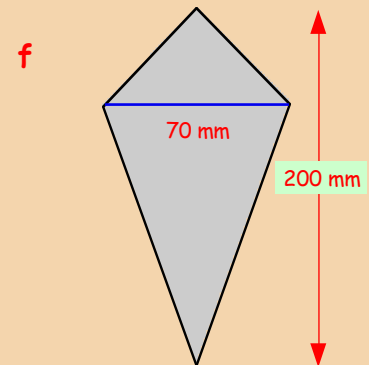
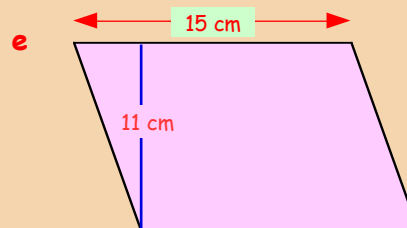
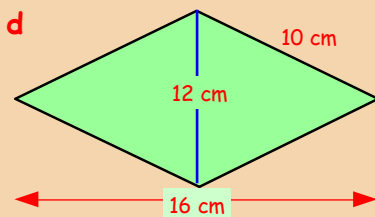
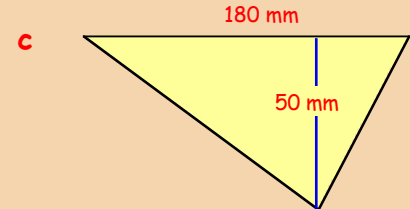
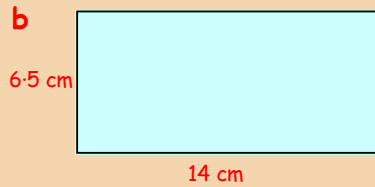
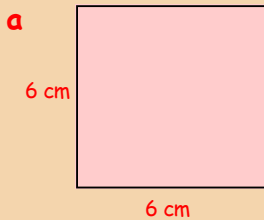


1. For each of these shapes :-

(i) Name the shape.

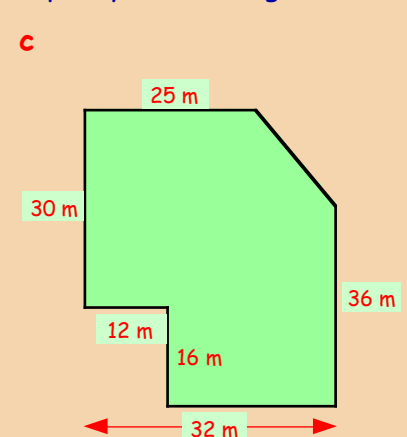
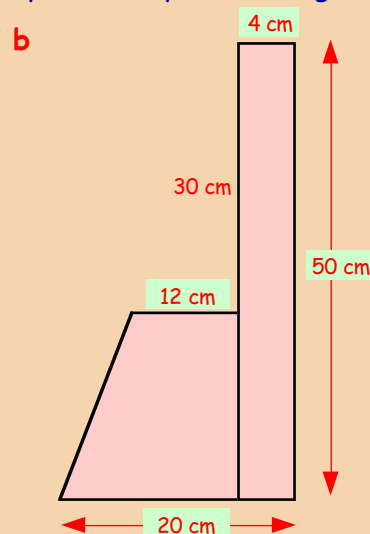
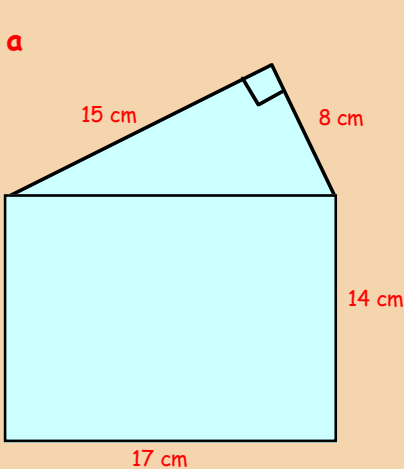
(ii) State what formula should be used to find its **area**.

(iii) Calculate its area.



2. Find, from Qu 1, the **perimeter** of the :- a square b rectangle c rhombus.

3. Calculate the **area** of these composite shapes, showing each step of your working :-



CHAPTER 9

Fractions

Fractions

Revision

Remember A fraction consists of two parts :-

$$\frac{3}{5} \quad \begin{array}{l} \leftarrow \text{numerator} \\ \leftarrow \text{denominator} \end{array}$$

Be able to
produce
an equivalent
fraction

You can obtain an **equivalent** fraction by multiplying top and bottom of a fraction by any number.

Example :-

$$\frac{3}{5} \text{ can become } \frac{3 \times 2}{5 \times 2} = \frac{6}{10}$$

You can **simplify** a fraction by dividing top and bottom of the fraction by a suitable number.

Example :-

$$\frac{12}{15} \text{ simplified is } \frac{12 \div 3}{15 \div 3} = \frac{4}{5}$$

Exercise 1

1. Find **two** equivalent fractions for each of the following :-

a $\frac{3}{4}$

b $\frac{1}{2}$

c $\frac{1}{3}$

d $\frac{2}{3}$

e $\frac{2}{5}$

f $\frac{5}{6}$

g $\frac{3}{10}$

h $\frac{1}{100}$

i $\frac{7}{9}$

j $\frac{11}{20}$

k $\frac{7}{15}$

l $\frac{9}{25}$

m $\frac{19}{21}$

n $\frac{1}{37}$

o $\frac{111}{157}$

p $\frac{7}{5}$

2. Simplify **fully** (where possible) :-

a $\frac{6}{8}$

b $\frac{16}{18}$

c $\frac{12}{15}$

d $\frac{15}{30}$

e $\frac{18}{24}$

f $\frac{36}{72}$

g $\frac{39}{52}$

h $\frac{39}{51}$

i $\frac{135}{150}$

j $\frac{35}{42}$

k $\frac{13}{131}$

l $\frac{1200}{1500}$

m $\frac{180}{360}$

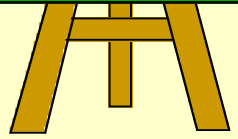
n $\frac{60}{900}$

o $\frac{108}{909}$

p $\frac{17}{51}$

Top-Heavy and Mixed Fractions

Be able to
convert between
top-heavy and
mixed fractions



A fraction like $\frac{17}{3}$, where the **numerator** is bigger than the **denominator**, is called a "top-heavy" fraction.

A number like $8\frac{2}{5}$, consisting of "whole" part and a "fraction" part, is called a "mixed" fraction.

Examples :- Changing a top-heavy fraction to a mixed fraction :-

1. $\frac{23}{4}$ really means $23 \div 4 \Rightarrow 4 \overline{)23}^5$ (remainder 3) $\Rightarrow 5\frac{3}{4}$

note :- the 3
is divided by
the 4

2. $\frac{25}{7}$ really means $25 \div 7 \Rightarrow 7 \overline{)25}^3$ (remainder 4) $\Rightarrow 3\frac{4}{7}$

note :- the 4
is divided by
the 7

Exercise 2

1. Copy and complete the following :-

a $\frac{17}{2}$ really means $17 \div 2 \Rightarrow 2 \overline{)17}^{\dots}$ (remainder) $\Rightarrow 8\frac{\dots}{2}$.

b $\frac{20}{3}$ really means $20 \div 3 \Rightarrow 3 \overline{)20}^{\dots}$ (remainder) $\Rightarrow 6\frac{\dots}{3}$.

c $\frac{23}{6}$ really means $23 \div \dots \Rightarrow \dots \overline{)23}^{\dots}$ (remainder) $\Rightarrow \dots\frac{\dots}{6}$.

d $\frac{17}{5}$ really means $\dots \div \dots \Rightarrow 5 \overline{)\dots}^{\dots}$ (remainder) $\Rightarrow \dots$



2. In a similar way, change the following top-heavy fractions to mixed numbers :-

a $\frac{13}{3}$

b $\frac{27}{4}$

c $\frac{38}{5}$

d $\frac{35}{6}$

e $\frac{73}{9}$

f $\frac{65}{8}$

g $\frac{87}{10}$

h $\frac{21}{6}$.

3. a 47 kg of apples are packed evenly into 6 plastic bags.

What weight of apples goes into each bag ?

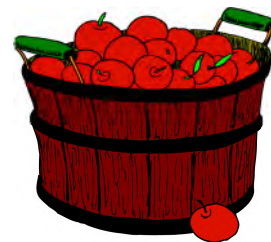
b Five boys decide to share 13 bars of chocolate evenly.

What will each boy receive (as a mixed number) ?

c A container holds 25 litres of water.

The water is poured into 4 jugs such that each holds the same amount.

How much water will be in each jug ?



3. d A petrol tanker holds half a million litres of fuel.

It empties this in equal amounts into 9 silos.

How much fuel will be in each silo ?

- e A truck depot petrol pump holds 8450 litres of diesel.

7 trucks use an equal amount of diesel.

How much diesel will each truck use from the full petrol pump ?



f



A plumber needs 137 metres of pipe to use in 8 identical houses.
He also needs 90 metres of plumbers' tape.

(i) How much pipe is needed for each house ?

(ii) How much tape will he use for each house ?

4. Copy and complete :- $\frac{20}{6} = 20 \div 6 = 3\frac{2}{6} = 3\frac{\dots}{3}$ ($\leftarrow$ simplified).

5. Change each of the following to mixed numbers and **simplify** where possible :-

a $\frac{27}{6}$

b $\frac{22}{4}$

c $\frac{28}{8}$

d $\frac{34}{10}$

e $\frac{18}{4}$

f $\frac{68}{8}$

g $\frac{75}{30}$

h $\frac{69}{6}$

i $\frac{30}{9}$

j $\frac{40}{16}$

k $\frac{65}{20}$

l $\frac{175}{100}$.

6. This diagram represents $2\frac{3}{4}$ pizzas.

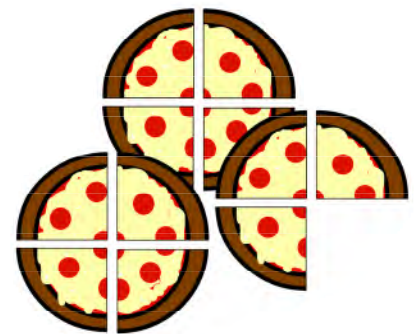
a How many " $\frac{1}{4}$ " pizza slices do you get from 1 pie ?

b How many " $\frac{1}{4}$ " pizza slices do you get from 2 pies ?

c How many " $\frac{1}{4}$ " pizza slices do you get from $\frac{3}{4}$ of a pie ?

d How many " $\frac{1}{4}$ " pizza slices is this altogether from the $2\frac{3}{4}$ pizzas ?

e Write this as $2\frac{3}{4} = \frac{\dots}{4}$.



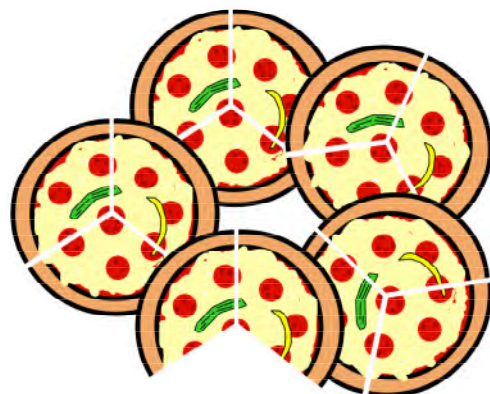
7. These "pizzas" have been cut into "thirds".

a From the 4 whole pizzas, you get thirds ?

b From the $\frac{2}{3}$ pizza, you get thirds ?

c How many thirds is this altogether ?

d Write this as $4\frac{2}{3} = \frac{\dots}{3}$.



Examples :- Changing a **mixed fraction** to a **top-heavy fraction** :-

- To change $6\frac{2}{3}$ into "thirds" • **Step 1** - multiply the 6 by the 3 - (6 becomes 18 "thirds")
 • **Step 2** - now add on the 2 (thirds) - ($18 + 2 = 20$ "thirds").

1. $6\frac{2}{3} = ((6 \times 3) + 2) \text{ thirds} = 20 \text{ "thirds"} = \frac{20}{3}$

2. $2\frac{5}{8} = ((2 \times 8) + 5) \text{ eighths} = 21 \text{ "eighths"} = \frac{21}{8}$



8. Copy and complete :-

a $3\frac{4}{5} = ((3 \times 5) + 4) \text{ "fifths"} = 19 \text{ "fifths"} = \frac{19}{5}$.

b $1\frac{3}{10} = ((1 \times 10) + 3) \text{ "tenths"} = 13 \text{ "tenths"} = \frac{13}{10}$.

c $2\frac{5}{8} = ((2 \times \dots) + \dots) \text{ "eighths"} = \dots \text{ "eighths"} = \frac{\dots}{8}$.

d $10\frac{1}{9} = ((\dots \times \dots) + \dots) \text{ "ninths"} = \dots \text{ "ninths"} = \frac{\dots}{9}$.



9. Copy and complete :-

a $4\frac{1}{5} = \dots\dots\dots$

b $2\frac{2}{3} = \dots\dots\dots$

c $8\frac{2}{5} = \dots\dots\dots$

d $2\frac{7}{10} = \dots\dots\dots$

10. Change each of the following mixed numbers to top heavy fractions :-

a $1\frac{1}{2}$

b $8\frac{1}{5}$

c $6\frac{2}{3}$

d $7\frac{2}{5}$

e $10\frac{3}{7}$

f $3\frac{8}{9}$

g $2\frac{9}{10}$

h $6\frac{19}{20}$.

11. How many $\frac{1}{2}$ pizza slices can I get from :-

a 2 pizzas

b 5 pizzas

c $3\frac{1}{2}$ pizzas

d $10\frac{1}{2}$ pizzas ?



12. How many $\frac{1}{5}$ litre glasses can be filled from :-

a 3 litres

b $1\frac{1}{5}$ litres

c $2\frac{2}{5}$ litres

d $6\frac{4}{5}$ litres ?

13. How many $\frac{1}{4}$ kg bags of salt can be filled from :-

a 2 kg

b $1\frac{1}{4}$ kg

c $4\frac{3}{4}$ kg

d $3\frac{1}{2}$ kg ?

14. Find :-

a $2\frac{3}{5} + 4\frac{4}{5}$ (Hint - we could change them to " $\frac{1}{5}$'s".)

b $3\frac{3}{7} + 1\frac{5}{7}$.

Adding and Subtracting (basic) Fractions

Be able to add or subtract basic mixed fractions

Simple Rule :- You can only add (or subtract) two fractions if

THEY HAVE THE SAME DENOMINATOR.

Example 1

$$\frac{3}{7} + \frac{2}{7} = \frac{5}{7}$$

Example 2

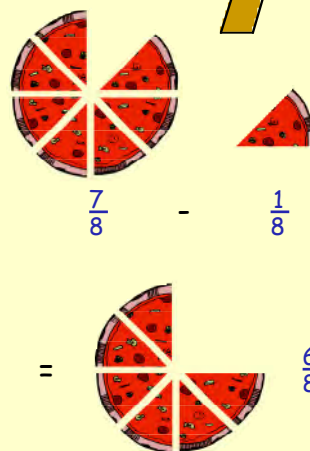
$$\frac{7}{8} - \frac{1}{8} = \frac{6}{8} (= \frac{3}{4})$$

Example 3

$$\begin{aligned} 2\frac{3}{5} + 1\frac{4}{5} \\ = 3\frac{7}{5} \\ = 4\frac{2}{5} \end{aligned}$$

Example 4

$$\begin{aligned} 5\frac{5}{6} - 1\frac{1}{6} \\ = 4\frac{4}{6} \\ = 4\frac{2}{3} \end{aligned}$$



Exercise 3

1. Copy and complete the following :-

a $\frac{3}{5} + \frac{1}{5}$
 $= \frac{\quad}{5}$

b $\frac{7}{9} - \frac{5}{9}$
 $= \frac{\quad}{9}$

c $\frac{7}{10} - \frac{3}{10}$
 $= \frac{\quad}{10} = \frac{\quad}{5}$

d $\frac{3}{8} + \frac{3}{8}$
 $= \frac{\quad}{8} = \frac{\quad}{4}$

2. Copy the following and **simplify** where possible :-

a $\frac{3}{7} + \frac{1}{7}$

b $\frac{5}{9} + \frac{3}{9}$

c $\frac{7}{9} - \frac{1}{9}$

d $\frac{3}{4} + \frac{3}{4}$

e $\frac{7}{12} - \frac{5}{12}$

f $\frac{11}{12} + \frac{11}{12}$

g $\frac{8}{15} + \frac{7}{15}$

h $\frac{15}{16} - \frac{7}{16}$

3. Copy the following and **simplify** where possible :-

a $2\frac{1}{3} + 3\frac{1}{3}$

b $5\frac{3}{5} - 1\frac{2}{5}$

c $4\frac{1}{7} + 3\frac{1}{7}$

d $2\frac{1}{2} + 1\frac{1}{2}$

e $6\frac{4}{5} - 6\frac{1}{5}$

f $4\frac{1}{5} + 3\frac{5}{9}$

g $5\frac{5}{9} - 1\frac{1}{9}$

h $10\frac{4}{11} + 3\frac{2}{11}$

4. Of the $\frac{9}{10}$ kilometre journey to his school, David had walked $\frac{3}{10}$ km.

How much further had he to go ?

5.



Hat sizes go up in $\frac{1}{8}$'s of an inch at a time.

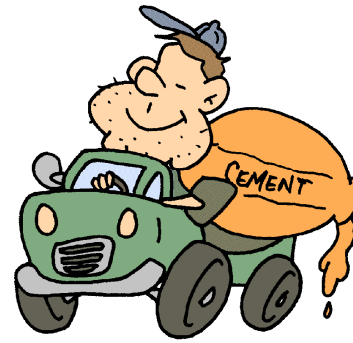
Paula wears a hat size $6\frac{7}{8}$. Alex is 5 sizes bigger than this.

What is Alex's hat size ?



6. John mixes $23\frac{3}{5}$ kg sand with $24\frac{4}{5}$ kg of cement.

What is the total weight of the mixture ?



7. a A piece of rope was $6\frac{3}{5}$ metres long.
A piece measuring $3\frac{2}{5}$ was cut off.

What length of rope remained ?

b



Two jugs of orange juice were poured into an empty basin.
The first jug held $2\frac{3}{4}$ litres and the second held $1\frac{3}{4}$ litres.

How much juice in **total** was in the basin ?

- c Of the $10\frac{5}{6}$ kilometres journey from his house to the shops,
Alan had cycled $7\frac{1}{6}$ kilometres.

How much further had Alan to cycle to reach the shops ?



- d George ate $\frac{4}{5}$ of his pizza, Billy ate $\frac{3}{5}$ of his and Amanda ate $\frac{2}{5}$ of hers.

How much had they eaten altogether ?

e



Bunty weighed $72\frac{7}{9}$ kilograms.

She went on a diet and lost $4\frac{4}{9}$ kilograms.

What is Bunty's new weight ?

8. A table measures $6\frac{7}{10}$ feet long by $4\frac{3}{10}$ feet wide.

- a By how much is the length bigger than the width ?
b Calculate the **perimeter** of the table top.



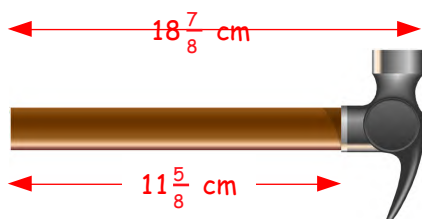
9. A lorry weighs $3\frac{7}{8}$ of a tonne. Crates are loaded onto the lorry.
Each crate weighs $\frac{5}{8}$ tonne.

What is the total weight of the lorry carrying a load of :-

- a 1 crate b 2 crates c 3 crates ?



10.



Look at the picture of the hammer.
Calculate the length of the metal part.

Adding and Subtracting (Harder) Fractions

Be able to add
or subtract
harder fractions

Remember the Golden Rule :-

The denominators **MUST** be the same if you wish to add or subtract.

Question :- What do we do if the denominators are **not** the same ?

Answer :- Change each fraction so that they **do have the same** denominator.

Example 1 :- Find $\frac{2}{3} + \frac{1}{2}$. [they do **not** add to give $\frac{3}{5}$ X]

- the denominators **3** and **2** are **not** the same.
- what is the **l.c.m.** (lowest common multiple) of 3 and 2 → **6**.
- we must change $\frac{2}{3}$ and $\frac{1}{2}$ to $\frac{1}{6}$'s.

$$\begin{aligned} \frac{2}{3} + \frac{1}{2} \\ \frac{4}{6} + \frac{3}{6} \\ = \frac{7}{6} = 1\frac{1}{6} \end{aligned}$$

note →

← note

$(\frac{2}{3} = \frac{?}{6}) \rightarrow ? = 4$
 $(\frac{1}{2} = \frac{?}{6}) \rightarrow ? = 3$

Example 2 :-

(8 and 5 go into 40)

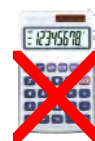
$$\begin{aligned} \frac{5}{8} - \frac{1}{5} \\ \frac{?}{40} - \frac{?}{40} \\ = \frac{25}{40} - \frac{8}{40} \\ = \frac{17}{40} \end{aligned}$$

Example 3 :-

(6 and 4 go into 12)

$$\begin{aligned} \frac{5}{6} + \frac{3}{4} \\ \frac{?}{12} + \frac{?}{12} \\ = \frac{10}{12} + \frac{9}{12} \\ = \frac{19}{12} = 1\frac{7}{12} \end{aligned}$$

Exercise 4



1. Copy each of the following and complete :-

a

$$\begin{aligned} \frac{3}{4} + \frac{1}{3} \\ = \frac{?}{12} + \frac{?}{12} \\ = \frac{?}{12} = 1\frac{?}{12} \end{aligned}$$

b

$$\begin{aligned} \frac{4}{5} - \frac{2}{3} \\ = \frac{?}{15} - \frac{?}{15} \\ = \frac{?}{15} \end{aligned}$$

c

$$\begin{aligned} \frac{7}{8} - \frac{3}{4} \\ = \frac{?}{8} - \frac{?}{8} \\ = \frac{?}{8} \end{aligned}$$

d

$$\begin{aligned} \frac{6}{7} + \frac{2}{3} \\ = \frac{?}{21} + \frac{?}{21} \\ = \frac{?}{21} \end{aligned}$$

2. Show how to simplify the following :-

a $\frac{2}{3} + \frac{1}{5}$

b $\frac{3}{4} - \frac{1}{2}$

c $\frac{5}{8} + \frac{2}{3}$

d $\frac{4}{5} + \frac{1}{2}$

e $\frac{5}{6} - \frac{1}{3}$

f $\frac{3}{4} - \frac{2}{3}$

g $\frac{7}{10} + \frac{2}{5}$

h $\frac{7}{9} - \frac{1}{2}$

3. Show your working here :-

a $\frac{1}{2} + \frac{1}{3} + \frac{1}{4}$

b $\frac{5}{6} - \frac{1}{2} - \frac{1}{3}$

c $\frac{2}{3} + \frac{3}{5} - \frac{1}{2}$.

Mixed Fractions :- Deal with the **whole numbers first** - then the fractions.

Example 4 :-

$$\begin{aligned} & 2\frac{1}{2} + 3\frac{2}{3} \\ &= 5(\frac{1}{2} + \frac{2}{3}) \\ &= 5(\frac{3}{6} + \frac{4}{6}) \\ &= 5\frac{7}{6} \\ &= 6\frac{1}{6} \end{aligned}$$

Example 5 :-

$$\begin{aligned} & 7\frac{7}{8} - 4\frac{2}{3} \\ &= 3(\frac{7}{8} - \frac{2}{3}) \\ &= 3(\frac{21}{24} - \frac{16}{24}) \\ &= 3\frac{5}{24} \end{aligned}$$

Example 6 :-

$$\begin{aligned} & 4\frac{3}{4} + 3\frac{5}{6} \\ &= 7(\frac{3}{4} + \frac{5}{6}) \\ &= 7(\frac{9}{12} + \frac{10}{12}) \\ &= 7\frac{19}{12} \\ &= 8\frac{7}{12} \end{aligned}$$

4. Copy and complete the following :-

a $8\frac{1}{3} + 2\frac{1}{2}$

b $4\frac{3}{4} - 2\frac{1}{3}$

c $5\frac{7}{8} - 3\frac{1}{4}$

d $9\frac{1}{2} + 1\frac{3}{5}$

e $2\frac{5}{6} - 1\frac{2}{3}$

f $9\frac{2}{3} + 11\frac{5}{8}$

g $17\frac{1}{5} + 12\frac{1}{4}$

h $51\frac{9}{10} - 50\frac{1}{2}$

i $16\frac{1}{3} + \frac{7}{9}$

j $14\frac{4}{5} + 10\frac{3}{4}$

k $1\frac{1}{10} + 2\frac{2}{5}$

l $15\frac{1}{4} - 15\frac{1}{6}$

m $11\frac{7}{10} - 10\frac{1}{15}$

n $12\frac{1}{2} - 10\frac{5}{13}$

o $1\frac{6}{7} - \frac{1}{4}$

p $47\frac{1}{4} - 46\frac{1}{12}$.

5. Copy and complete the following :-

a $7 - 4\frac{1}{3}$
 $= 3 - \frac{1}{3}$
 $(7 - 4) \rightarrow = 2\frac{2}{3}$

b $15 - 13\frac{2}{5}$
 $= 2 - \frac{2}{5}$
 $= 1\frac{3}{5}$

c $20 - 17\frac{5}{8}$
 $= 3 - \frac{5}{8}$
 $= 2\frac{3}{8}$

d $14 - 13\frac{3}{5}$
 $= 1 - \frac{3}{5}$
 $= \frac{2}{5}$.

6. Use the above method to find :-

a $4 - 1\frac{1}{5}$

b $6 - 3\frac{4}{7}$

c $10 - 5\frac{5}{6}$

d $6 - 4\frac{3}{5}$

e $5 - 4\frac{7}{10}$

f $35 - 29\frac{3}{8}$

g $12 - 6\frac{5}{7}$

h $8 - 3\frac{1}{3}$.

7.



From a 6 metre length of cable, the engineer cut off a piece which was $3\frac{3}{8}$ metres long. What was the length of the piece of cable remaining?

8. It is exactly twelve and a half miles from Bromley to Cardrew.

Davie and Bob left Bromley and jogged for $7\frac{5}{8}$ miles before stopping for a rest.

How much further had they still to jog to get to Cardrew?



A Problem with Subtraction :- $4\frac{1}{3} - 1\frac{3}{5}$?

- **Step 1** - Subtract whole numbers first $\rightarrow 3$ and $(\frac{1}{3} - \frac{3}{5})$
- **Step 2** - Change both fractions to $\frac{15}{15}$'s $\Rightarrow 3$ and $(\frac{5}{15} - \frac{9}{15})$
(* you cannot take $\frac{9}{15}$ from $\frac{5}{15}$!!!!)
- **Step 3** - Take 1 whole number from the 3 and write it as $\frac{15}{15}$ (= 1)

$$\begin{aligned} &\rightarrow 3(\frac{5}{15} - \frac{9}{15}) \\ \text{becomes } &2 + \frac{15}{15} + (\frac{5}{15} - \frac{9}{15}) = 2 + \frac{20}{15} - \frac{9}{15} \\ &= 2\frac{11}{15} \end{aligned}$$

Example 7 :-

change the
5 to become
 $4 + \frac{12}{12}$

$$\begin{aligned} &6\frac{1}{4} - 1\frac{2}{3} \\ &= 5(\frac{1}{4} - \frac{2}{3}) \\ &= 5(\frac{3}{12} - \frac{8}{12}) \\ &= 4 + \frac{12}{12} + (\frac{3}{12} - \frac{8}{12}) \\ &= 4\frac{7}{12} \end{aligned}$$

Example 8 :-

$$\begin{aligned} &5\frac{3}{5} - 1\frac{5}{6} \\ &= 4(\frac{3}{5} - \frac{5}{6}) \\ &= 4(\frac{18}{30} - \frac{25}{30}) \\ &= 3 + \frac{30}{30} + (\frac{18}{30} - \frac{25}{30}) \\ &= 3\frac{23}{30} \end{aligned}$$

9. Copy and complete the following :-

a $5\frac{2}{5} - 1\frac{1}{2}$
 $= 4(\frac{2}{5} - \frac{1}{2})$
 $= 4(\frac{4}{10} - \frac{5}{10})$
 $= 3 + \frac{10}{10} + (\frac{4}{10} - \frac{5}{10})$
 $= 3\frac{\dots}{10}$

b $4\frac{3}{8} - 2\frac{3}{5}$
 $= 2(\frac{3}{8} - \frac{3}{5})$
 $= 2(\frac{15}{40} - \frac{24}{40})$
 $= 1 + \frac{40}{40} + (\frac{15}{40} - \frac{24}{40})$
 $= 1\frac{\dots}{40}$

c $6\frac{1}{5} - \frac{3}{4}$
 $= 6(\frac{1}{5} - \frac{3}{4})$
 $= 6(\frac{4}{20} - \frac{15}{20})$
 $= 5 + \frac{\dots}{20} + (\frac{4}{20} - \frac{15}{20})$
 $= 5\frac{\dots}{20}.$

10. Show all your working here :-

a $4\frac{1}{5} - 1\frac{1}{2}$

b $6\frac{3}{5} - 1\frac{5}{6}$

c $4\frac{1}{4} - 2\frac{1}{2}$

d $6\frac{3}{8} - 4\frac{3}{4}$

e $10\frac{1}{3} - 7\frac{1}{2}$

f $6\frac{1}{7} - 1\frac{1}{2}$

g $8\frac{1}{3} - 3\frac{7}{10}$

h $8\frac{1}{6} - 5\frac{2}{5}.$

11. What is the difference in each of the following hat sizes :-

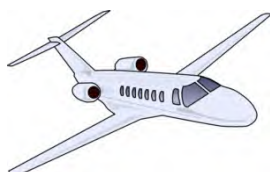
a $7\frac{3}{4}$ and $6\frac{1}{2}$

b $6\frac{1}{2}$ and $6\frac{5}{8}$

c $8\frac{3}{4}$ and $6\frac{7}{8}$?



12.



Of the $7\frac{1}{2}$ hours my flight takes to New York,
I had flown $4\frac{3}{4}$ hours of it.
How much longer did my journey take ?

The 3 Я's

Revisit - Review - Revise



1. Write down three equivalent fractions for :-

a $\frac{1}{4}$

b $\frac{2}{3}$

c $\frac{4}{7}$

d $\frac{1}{15}$.

2. Find and **simplify** where possible :-

a $\frac{3}{8} + \frac{1}{8}$

b $\frac{7}{10} - \frac{3}{10}$

c $\frac{1}{3} + \frac{1}{2}$

d $\frac{1}{5} + \frac{1}{3}$

e $\frac{1}{6} + \frac{1}{2}$

f $\frac{1}{4} - \frac{1}{8}$

g $\frac{2}{3} + \frac{1}{4}$

h $\frac{3}{4} - \frac{1}{2}$

i $\frac{1}{2} - \frac{2}{5}$

j $\frac{7}{8} - \frac{3}{5}$

k $\frac{9}{10} - \frac{4}{5}$

l $\frac{11}{16} - \frac{3}{8}$.

3. Find :-

a $\frac{1}{2} + \frac{1}{3} + \frac{1}{5}$

b $\frac{2}{3} + \frac{1}{2} + \frac{1}{8}$

c $\frac{4}{5} + \frac{3}{4} - \frac{2}{3}$.

4. Change each of the following into a **top heavy fraction** :-

a $1\frac{1}{3}$

b $2\frac{3}{5}$

c $5\frac{3}{8}$

d $10\frac{9}{10}$.

5. Change each of the following into a **mixed number** :-

a $\frac{7}{4}$

b $\frac{14}{5}$

c $\frac{22}{3}$

d $\frac{100}{13}$.

6. Find each of the following, leaving your answer as a **mixed number** :-

a $\frac{4}{3} + \frac{5}{4}$

b $1\frac{1}{5} + 2\frac{3}{5}$

c $6\frac{7}{8} - 2\frac{3}{8}$

d $2\frac{1}{2} + 3\frac{1}{3}$

e $5\frac{1}{4} + 1\frac{3}{8}$

f $6\frac{5}{6} - 4\frac{1}{3}$

g $10\frac{3}{4} - 7\frac{1}{2}$

h $3\frac{3}{7} + 1\frac{2}{5}$

i $4\frac{1}{3} - 1\frac{1}{2}$

j $7\frac{2}{5} - 3\frac{2}{3}$

k $6 - 2\frac{3}{7}$

l $11 - 7\frac{3}{10}$.

7. After a party, I was left with $3\frac{3}{4}$ cold pizzas.

Next morning my friends and I ate $1\frac{1}{3}$ of them.

The rest, we threw out. How many were thrown out ?



8.

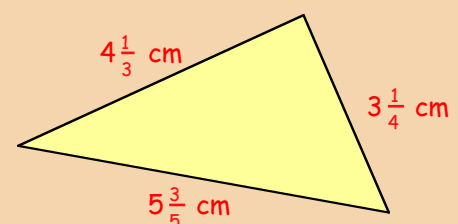


Wendy set out to run a marathon which is approximately $26\frac{1}{5}$ miles long.

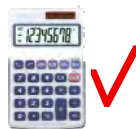
She pulled a hamstring muscle after $17\frac{3}{4}$ miles and had to stop.

How far short of the finishing line was she then ?

9. Calculate the **perimeter** of this triangle.



CHAPTER 10



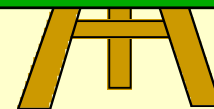
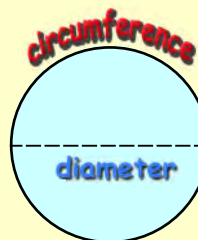
The Circle 1

The Circumference (C) of a Circle

Calculator may be used in this chapter

Investigate the circumference of a circle

A long time ago, it was discovered that there was a connection between the length of the **diameter** of a circle and the length of its **circumference**.



Exercise 1

Practical Exercise

- Collect 5 or 6 circular objects, such as :- an old CD, £2 coin, bicycle wheel, toy drum, waste bin top, plate, can of juice, tyre, plant pot, clock face, battery, frisbee etc....
 - Use a ruler or a measuring tape to measure each diameter.
 - Measure each circumference using the measuring tape or a piece of string and a ruler, depending on the size of the object.
 - As you make each measurement, enter your results in your jotter using a table like the one shown below.



You have to use your calculator to find the answer to the 4th row by :-

dividing the circumference of each circle by its diameter.

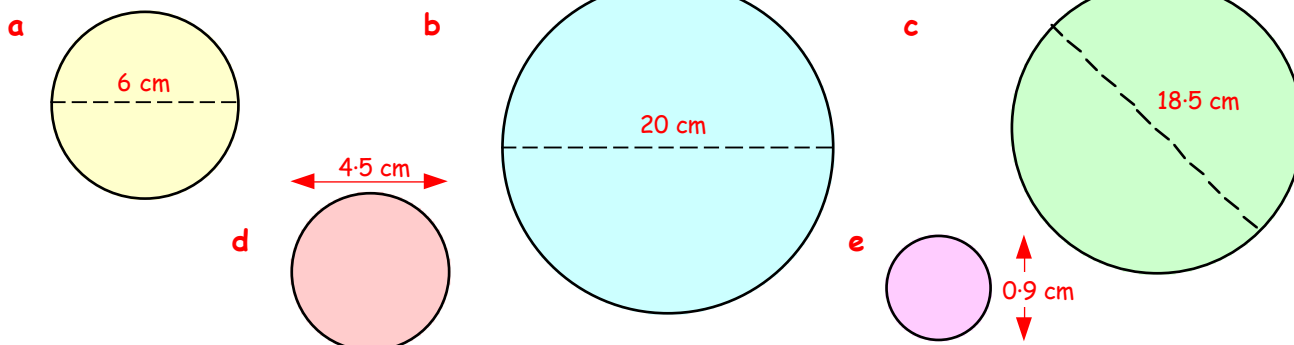
OBJECT	can	plate	.....	.....	.....	
diameter (D)	8 cm	.....	.....	.....	.....	
circumference (C)	25 cm	.....	.....	.....	.....	.....
$C \div D$	$25 \div 8 =$	.....	.....	.....	.....	.....

What was the nearest **whole number** to your answer each time ?

Just like the ancient Egyptians, you should have found that :-

The Circumference of a circle is approximately 3 times its Diameter.

- Use the above fact, that C (approximately) $= 3 \times D$ to estimate the circumference of the circles shown below:-

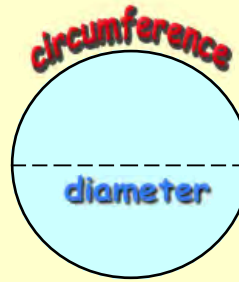


The Circumference (C) of a Circle (Formula)

Be able to use a formula to find the circumference of a circle

It has been known for a long time that when you divide the **circumference** of a circle by its **diameter** you always get the answer 3.1415927...

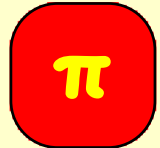
$$\Rightarrow \frac{C}{D} = 3.14\dots$$



This number (3.1415927.....) is so famous in mathematics, it is given a name.

It is called π ("pi", pronounced as "pie").

$$\Rightarrow \frac{C}{D} = \pi \quad (\text{where } \pi \text{ is rounded to } 3.14.)$$

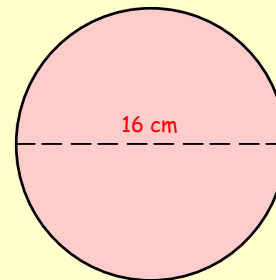


We can use the rearrangement of this to help us calculate the circumference of a circle as long as we know what its diameter is.

$$\Rightarrow C = \pi D \quad \text{very famous formula - to be learned !!!}$$

Example :- Calculate the circumference of this circle which has a diameter of 16 centimetres :-

$$\begin{aligned} C &= \pi D \\ \Rightarrow C &= 3.14 \times 16 \\ \Rightarrow C &= 50.24 \text{ cm} \end{aligned}$$



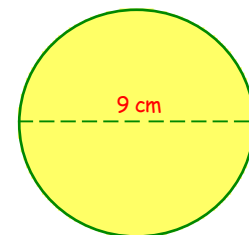
* If you have a Scientific Calculator - ask your teacher about the π button !

Exercise 2

1. Calculate the circumference of a circle with diameter 9 cm.

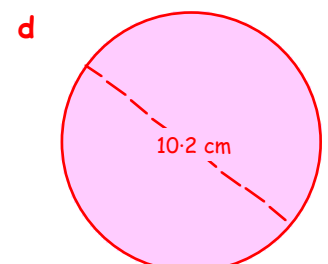
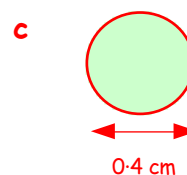
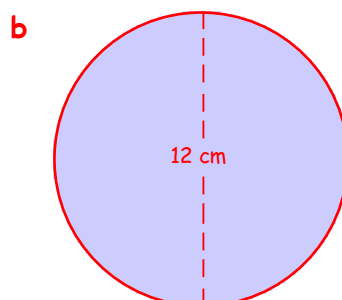
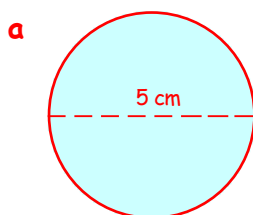
Copy and complete :-

$$\begin{aligned} \Rightarrow C &= \pi D \\ \Rightarrow C &= 3.14 \times 9 \\ \Rightarrow C &= \dots\dots\dots \text{ cm.} \end{aligned}$$



2. Calculate the circumference of each circle below :-

(You **must** set down **3 lines of working** for each).

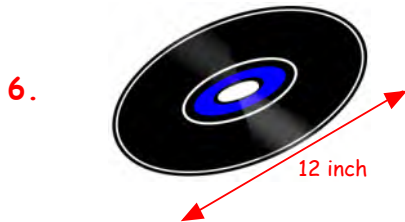


3. The face of this alarm clock has a diameter of 8.8 centimetres.
Calculate the **circumference** of the clock face.



The diameter of this dartboard is 32 centimetres.
Calculate its **circumference**.

5. This road sign has a diameter of 54 centimetres.
Calculate its **circumference**.

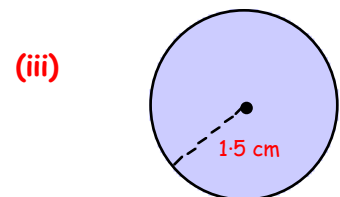
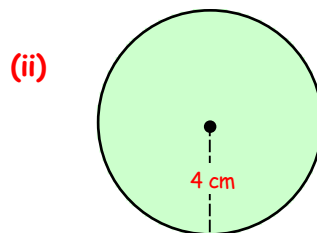
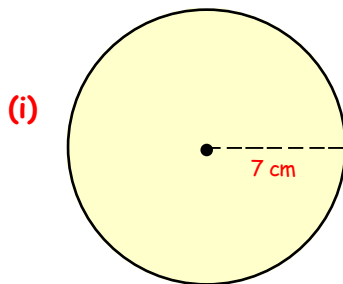


Calculate the **circumference** of this old 12 inch vinyl record.

7. If the radius of a circle is 10 centimetres, what is the length of its diameter ?

Remember :- if you are given a **radius**, you need to **double** it to find the **diameter**.

8. For each of the following circles :-
 a write down its diameter and then ...
 b calculate the length of its circumference.



9. The **radius** of this smiley face is 3.25 centimetres.

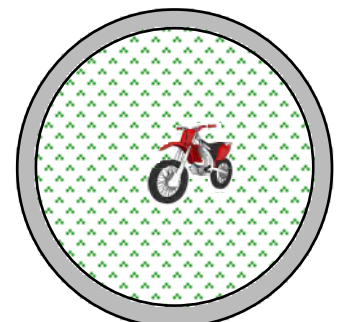
- a Write down the length of its diameter.
 b Calculate the distance around the outside of the face (the circumference).



10. This circular mouse-hole has a radius of 3.2 centimetres.
 a What is the diameter of the mouse hole ?
 b Calculate the circumference of the hole.

11. Shown is a circular motorcycle race track.
The radius of the track is 60 metres.

- a Calculate the distance round one lap of the track.
 b A motor cyclist goes around the track 40 times during a race. How far has he travelled **altogether** ?



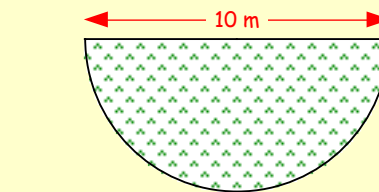
The Circumference of a Circle - Problems

Be able to find perimeters of half/quarter circles

Example :- Calculate the length of edging required to go around the **perimeter** of this semi-circular garden.

*(The **perimeter** of a shape is the **total distance** around the shape.)

$$\begin{aligned}
 C &= \pi D \\
 \Rightarrow C &= 3.14 \times 10 \\
 \Rightarrow C &= 31.4 \text{ m} \\
 \text{Circumference of Circle} &= 31.4 \text{ m} \\
 \text{Length of Semi-Circle} &= 31.4 \div 2 = 15.7 \text{ m} \\
 \text{Perimeter of Shape} &= 15.7 \text{ m} + 10 \text{ m} \\
 &= 25.7 \text{ m.}
 \end{aligned}$$



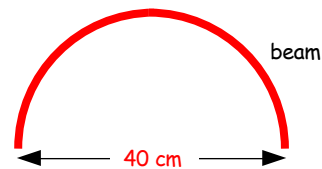
The **diameter**.

* For a **quarter circle** ... find the circumference of the full circle and $\div 4$.

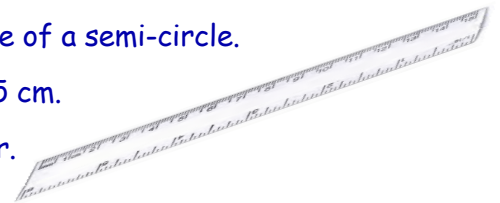
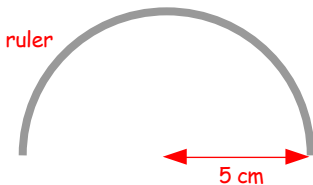


Exercise 3

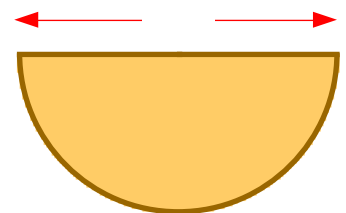
1. A wooden beam, in the shape of a semi-circle, has a diameter of 40 centimetres.
Calculate the length of the wooden beam.



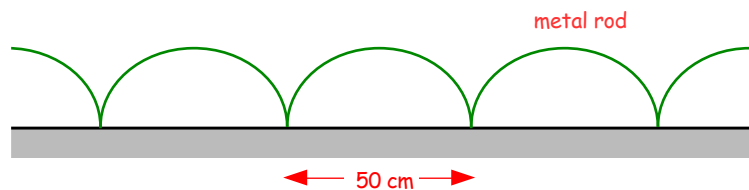
2. A plastic ruler is bent into the shape of a semi-circle. The radius of this semi-circle is 5 cm.
Calculate the length of the ruler.



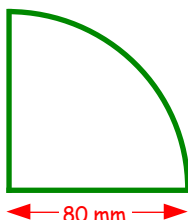
3. Trevor has a worktop with a semi-circular top. He strengthens it by putting hard plastic around its entire edge.
What length of hard plastic did he use ? (**Hint** :- the perimeter).



4. A garden path has a fence made from strips of metal rod bent into semi-circles. Each semi-circle has a diameter of 50 centimetres.
Find the length of metal rod needed to make the fence which has to be 8 metres long.

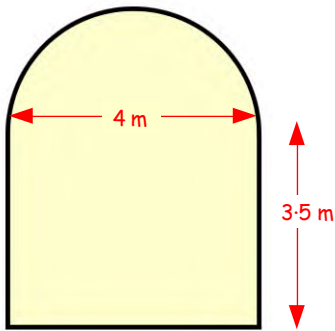


5. The diagram shows a quarter circle with radius 80 mm.
Work out the length of the curved part and hence the perimeter of the shape.

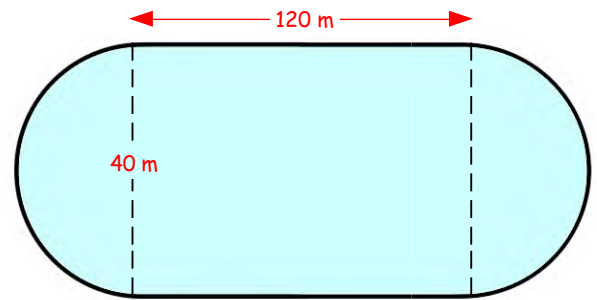


6. Calculate the **perimeter** of each shape : -

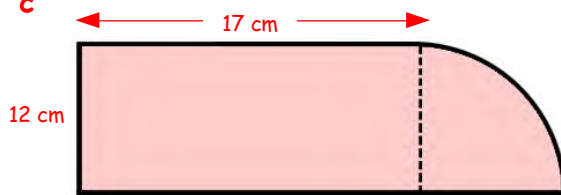
a



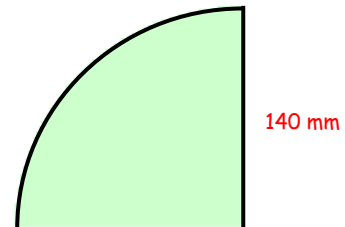
b



c



d



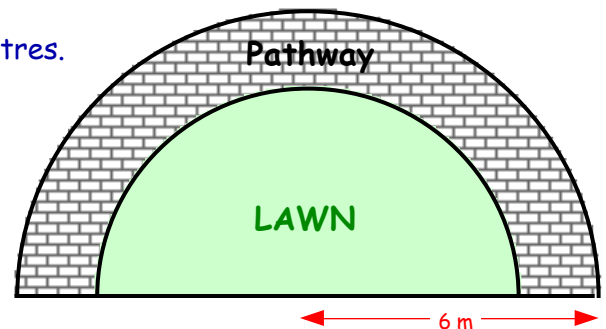
7. The semi-circular garden shown has a radius of 6 metres.

A semi-circular brick pathway **one metre wide** partly surrounds the grass lawn.

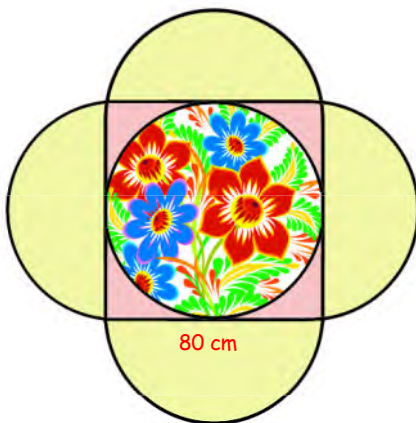
Find the perimeter of : -

a the grass lawn

b the brick path.



8.



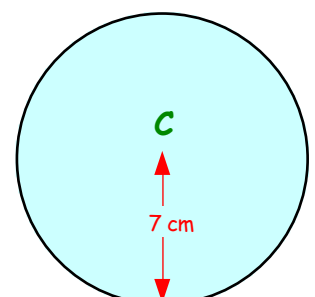
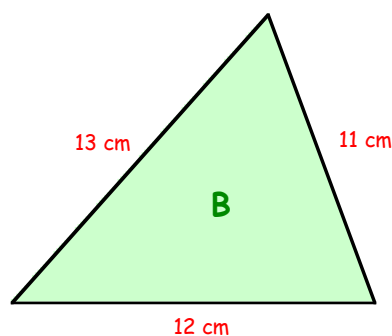
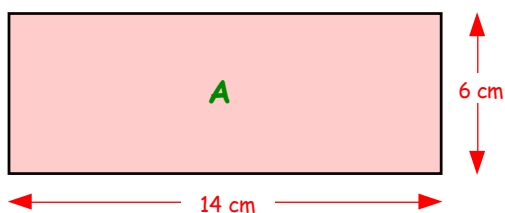
A florist uses this flower pattern as her logo.

The pattern is formed from a square, four semi-circles and a circle.

The front of the shop has this design, made from wrought iron, bolted onto it.

If the square has each side 80 cm, what length of iron bar was needed to make the whole logo ?

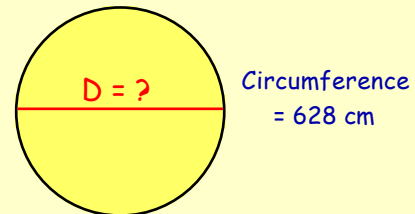
9. Which of the three shapes below has the **smallest perimeter** ?
(Show all your working).



Be able to find the diameter & radius of a circle given the circumference

$$C = \pi D$$

A diagram of a chair with a question mark next to it, indicating a question about the chair's structure or function.

$$C = \pi D$$
$$628 = 3.14 \times D$$
$$D = \frac{628}{3.14} = 200 \text{ cm}$$


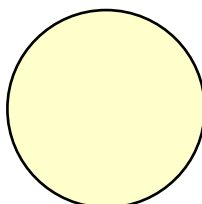
You can see that the formula needed to calculate the diameter is :-

A diagram showing the formula $D = \frac{C}{\pi}$ inside a light green box. A red arrow points from the word "Diameter" to the variable D . Another red arrow points from the word "Circumference" to the variable C . A third red arrow points from the value "3.14" to the constant π .

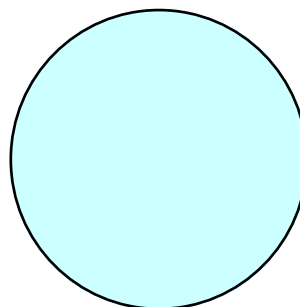
1. Find the diameter of a circle with circumference 219.8 cm.

$$D = \frac{C}{\pi}$$
$$\Rightarrow D = \frac{219.8}{3.14}$$
$$\Rightarrow D = \text{..... cm}$$

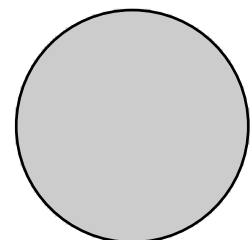
a


$$C = 25.12 \text{ cm}$$

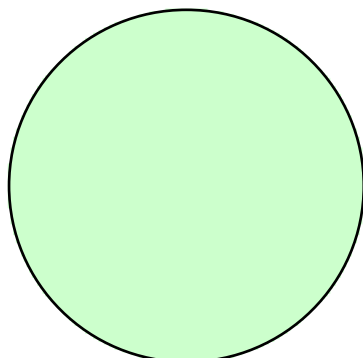
b


$$C = 53.38 \text{ cm}$$

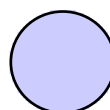
C


$$C = 314 \text{ m}$$

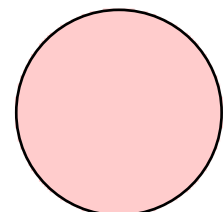
d


$$C = 10\,032.3 \text{ mm}$$

e


$$C = 6.28 \text{ mm}$$

f


$$C = 18.84 \text{ m}$$

3. Find the diameter of a circle with circumference :-

a 15.7 cm

b 175.84 mm

c 266.9 m.

4. Write down the **radius** of each of the circles in question 3.

5. Find the radius of a circle with :-

a circumference 1256 centimetres.

b perimeter 785 millimetres.

6. (Give answers to **3 significant figures**, unless otherwise asked).

a Determine the diameter of the wooden barrel given that its circumference is 90 centimetres.



b



$C = 3$ cm

Find the diameter of the circular standby button if its circumference is 3 cm in length.

c

The circumference of this tyre is 1 metre.

Work out the radius of the tyre in cm.



d



$C = 32$ cm

A slice of rolled roast beef has a circumference of 32 cm.

Find the radius of the slice.

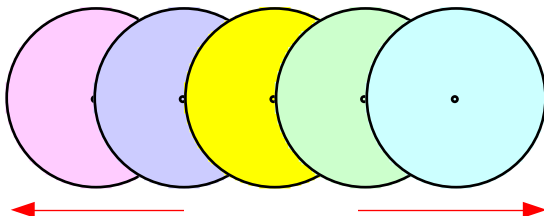
e

A circular cog in a watch mechanism has a circumference of 1 millimetre.

Find the radius of the cog to 2 decimal places.



7.



A company logo uses five circles, each with a **circumference** of 50 cm, which overlap as shown.

Find the total length of the company logo.

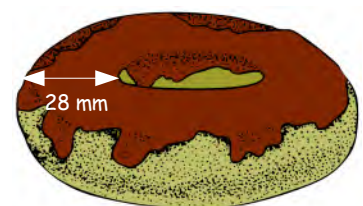
8. A doughring has an outer circumference of 251.2 mm.

The dough of the doughring is 28 mm thick.

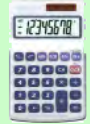
Calculate :-

a the outer diameter of the doughring.

b the circumference of the hole.



$C = 251.2$ mm



Give all answers correct to 3 significant figures and with correct units.

1. Calculate the **circumference** of each of these :-

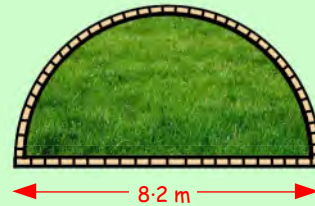
a



b



2. Zoe has a semi-circular lawn.
She decides to surround the lawn with edging slabs.
Calculate what length of edging she requires.



- 3.



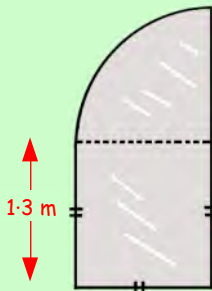
$$C = 125.6 \text{ cm}$$

Calculate the **diameter** of a bicycle wheel,
whose **circumference** is 125.6 centimetres.

4. Work out the **radius** of this circular table top
which has a **circumference** of 534 centimetres.



- 5.

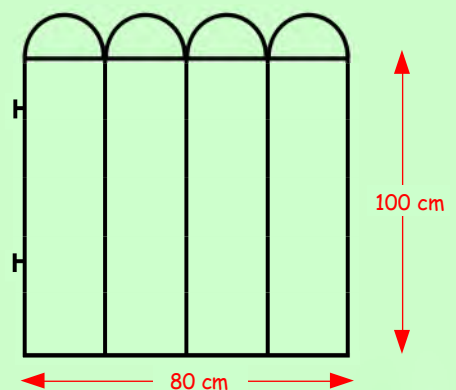


The side view of a glass conservatory is shown.
It has weatherproof coating all around the **outside**.
Calculate its **perimeter**, where this coating was used.

6. A decorative gate, made of black iron rod, consists of a rectangular base
with four identical semi-circular loops on top.

- a Use the figure to help find the **diameter**
of each semi-circle and then show that you
need **almost 8** metres of rod, to make it.
(You have to purchase it by the metre).

- b Black iron rod costs £12 per metre.
On top of this, the blacksmith also
charged £105.20 to make the gate.
What was the final cost of the gate?



CHAPTER 11

Ratio

Understanding Ratio

Ratios are used to compare various numbers of objects.

This picture shows 3 buses and 4 cars.



We say that "the ratio of buses to cars" is 3 to 4.

Or for short :- **buses : cars = 3 : 4.**
(: is the symbol for ratio).

Note :-

The ratio of **cars to buses** is 4 : 3.

Be able to
compare different
quantities using
ratio

Exercise 1

1. Look at this picture. Write down the ratio of :-

- a butterflies : birds b birds : butterflies.

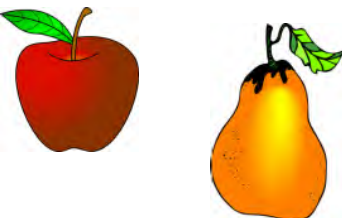


2.  a Write down the ratio of mice : cats.
b Write down the ratio of cats : mice.

3. In a cafe there are 9 tables and 19 chairs.
Write down the ratio of :-

- a tables to chairs b chairs to tables.



4.  In an orchard, there are 23 apple trees and 29 pear trees.
What is the ratio of :-

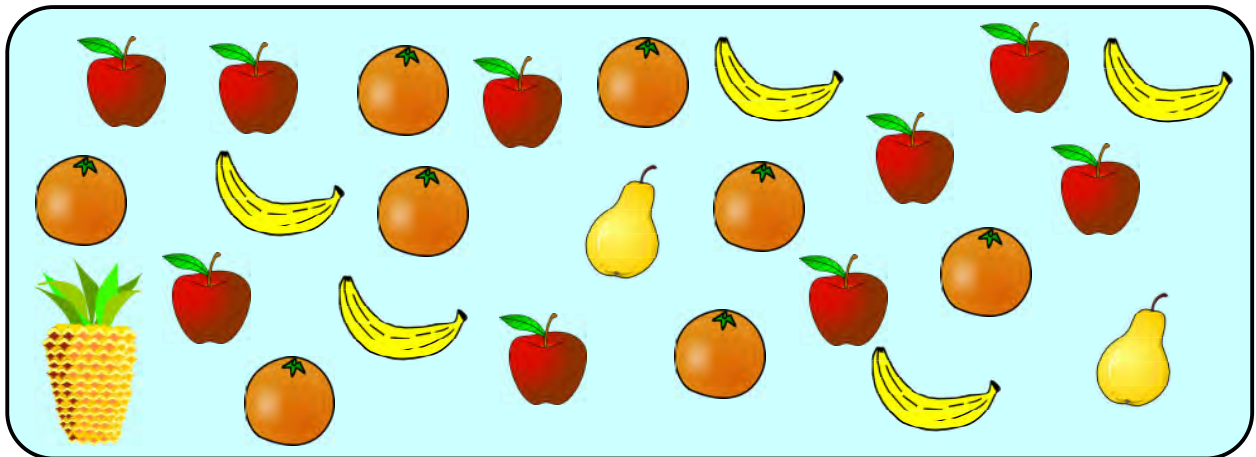
- a pear trees to apple trees
b apple trees to pear trees ?

5. In her bag, Granny Smith has 2 onions and 15 potatoes.
What is the ratio of :-

- a onions to potatoes b potatoes to onions
c onions to vegetables d vegetables to potatoes ?



6. In a shop window, there are apples, oranges, pears, bananas and pineapples.



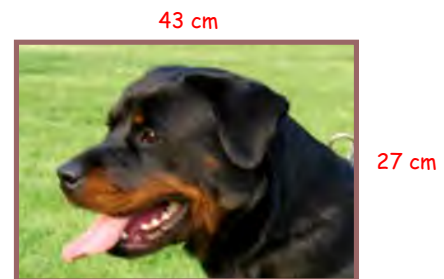
What is the ratio of :-

- | | | |
|---------------------|------------------------|---------------------------|
| a apples : oranges | b bananas : pears | c pears : apples |
| d oranges : bananas | e pineapples : bananas | f bananas : other fruit ? |

7. Shown is a framed picture of Ben the Rottweiler.

It is 43 cm long and 27 cm broad.

- a Write down the ratio, length : breadth.
 b Write down the ratio, breadth : length.
 c Write down the ratio, length : **perimeter**.



- 8.



A mother seal is fed 20 fish for every 3 fish for its baby.
 Write down :-

- a the ratio of fish for mother : fish for baby.
 b the ratio of fish for baby : number of fish for both.

9. A newspaper has 60 pages of which 13 are on advertising and the rest on news and sport.

Write down the ratio of pages :-

- a advertising : total number of pages
 b advertising : news & sport
 c news & sport : advertising.



- 10.



During September and October, there were 50 days of recorded rainfall.

Write down the ratio of :-

- a wet days : total days.
 b wet days : dry days.

Simplifying Ratio

Be able to
simplify any given
ratio as far as
possible

"**Simplifying**" a ratio is much the same as "**simplifying**" a fraction.

Remember :- The fraction $\frac{9}{12}$ can be simplified, since 9 and 12 are part of the "3 times" table.

$$\frac{9}{12} \Rightarrow \frac{9 \div 3}{12 \div 3} = \frac{3}{4}$$

Similarly, the ratio **9 : 12** can be simplified to give to **3 : 4** (This is called its - simplest form).

Exercise 2

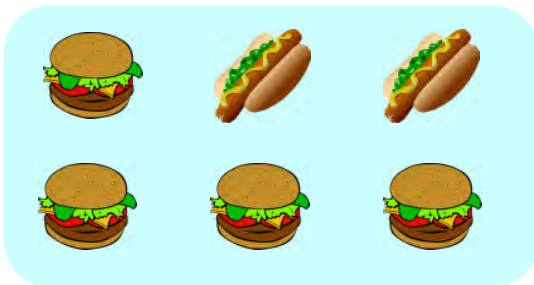
- By dividing both numbers by 2, simplify the ratio 10 : 6.
- By dividing both numbers by 9, simplify the ratio 54 : 63.
- Copy each of the following ratios and simplify each as far as possible :-

a 4 : 6 **b** 15 : 18 **c** 13 : 26 **d** 12 : 32 **e** 5 : 5 **f** 36 : 6
g 18 : 9 **h** 36 : 24 **i** 36 : 18 **j** 35 : 49 **k** 30 : 45 **l** 50 : 80
m 90 : 40 **n** 77 : 55 **o** 81 : 6 **p** 11 : 99 **q** 6 : 600 **r** 400 : 8
s 27 : 81 **t** 54 : 24 **u** 17 : 1700 **v** 3 : 12 000 000.

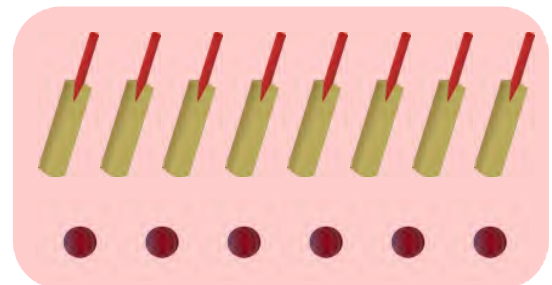
- Write down each **ratio** from the picture, then write it in its **simplest form**.

(e.g. ratio of burgers to hot-dogs is 4 : 2 = ... : ...)

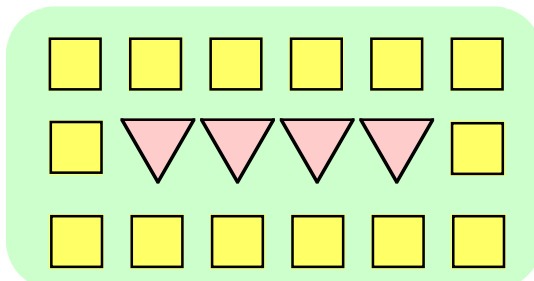
a



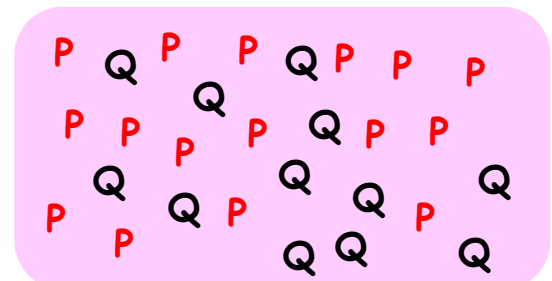
b



c

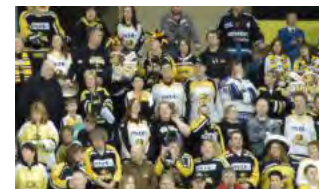


d



- At a football match there were 4 stewards for every 200 fans.

- What was the ratio of fans to stewards ?
- Give this ratio in its **simplest form**.



6. There are 15 pipers and 5 drummers in a pipe band.

a Write down the ratio of pipers : drummers.

b Simplify this ratio **as far as possible**.



7.



On a school trip, there are 36 pupils and 9 teachers.

Write, in its **simplest form**, the ratio of :-

a pupils : teachers

b teachers : pupils.

8.

Of the 36 pupils on the bus, 16 are girls.

a Write down the ratio of boys : girls.

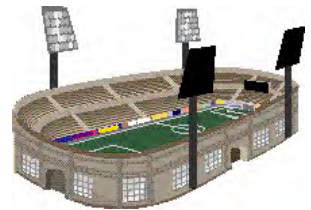
b Simplify this as far as possible.

9. The crowd capacity of a football stadium in the 1st Division is 80 000.

A smaller stadium in Division 2 can hold up to 16 000 people.

a Write down the ratio of **larger** capacity : **smaller** capacity.

b Simplify this as far as possible.



10.



Ari the dentist charges £55 per hour for a private consultation.

Ena charges £44 for the same period.

a Write down the ratio of their charges :- Ena : Ari.

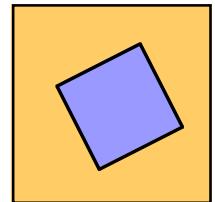
b Simplify this as far as possible.

11. The small square has each of its sides 12 mm long.

The larger square has its sides 44 mm long.

a Write down the ratio of their **perimeters** :- small : large.

b Simplify this as far as possible.



12. A large rectangle measures 8 m by 9 m and a smaller rectangle measures 6 m by 10 m.

a Write down the ratio of their **areas** :- larger : smaller.

b Simplify this ratio as far as possible.

13. Doreen is 25 years old and her daughter Fran is 5.

a Write down and simplify the ratio of Doreen's age : Fran's age.

b Write down and simplify what the ratio of their ages will be in 10 years time.

c How old will Fran be when the ratio of their ages becomes 2 : 1 ?



14. Write each of these ratios in its simplest form :-

- a 1 millimetre : 1 cm b 1 gram : 1 kilogram c 20 seconds : 1 minute
d 40p : £8 e 1 month : 1 year f 50 centimetres : 4 metres
g £2.50 : £10 h days in a week : days in a leap year
i minutes in an hour : minutes in a day.

15. Jess earns £6.30 per hour working in ORKAM Stores.

Tina earns £8.10 per hour in AEKI Stores.

- a Write down the ratio of their wages :- Jess : Tina.
b Simplify this as far as possible.

Given a Ratio, be able to determine a missing quantity, knowing the other.

Ratio Calculations

Example 1 :- In Granton Tennis Club, the ratio of juniors to seniors is :-

$$\text{juniors : seniors} = 2 : 5.$$



If there are 40 junior members, how many seniors are there ?

Set down like this :- since $40 = 20 \times 2$

$$\text{then seniors} = 20 \times 5 = 100$$

girls	boys
$\times 20$ 2 40	5 100 $\times 20$

Example 2 :- To obtain a particular strength of plant food, Gerry has to mix fertiliser and water in the ratio :-

$$\text{fertiliser : water} = 2 : 3.$$

Gerry actually uses 10 measures of fertiliser.

How many measures of water is required ?

Set down like this :- since $10 = 5 \times 2$

$$\text{then water} = 5 \times 3 = 15$$



fertiliser	water
$\times 5$ 2 10	3 15 $\times 5$

Exercise 3

1. In a classroom, the ratio of boys to girls = 1 : 3.

There are 7 boys in the classroom.

How many girls are there ?

boys	girls
$\times ?$ 1 7	3 $\times ?$

2. To make a Summer Punch, I use 1 litre of apple juice to 4 litres of orange juice.

=> the ratio of apple to orange juice is :- 1 : 4.

If I use 8 litres of apple juice, how many litres of orange juice should I use ?



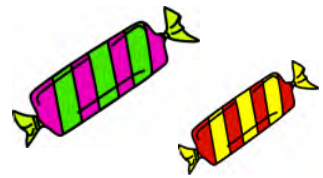
3. Flavoured chew sweets are sold in lemon and strawberry flavours in a 2 : 3 ratio.

a How many strawberry sweets should there be if there were :-

- (i) 12 lemon (ii) 32 lemon sweets.

b How many lemon sweets would there be if there were :-

- (i) 12 strawberry (ii) 81 strawberry sweets.



4. Some people recommend that in hospitals a decent ratio of nurses to doctors is 9 : 2.

How many doctors would be required for hospitals with :-

- a 18 nurses b 45 nurses
c 72 nurses d 135 nurses ?



5. One evening at the local cinema, the ratio of males to females was 3 : 4.

There were 120 men in the cinema.

How many women were there ?



Males	Females
3	4
x ?	x ?
120	.....

6. In a large crate, the ratio of red peppers to green peppers is 3 : 5.

If there are 102 red peppers in the crate, how many green peppers are there ?



7. In a box of chocolates, the ratio of soft : caramel is 2 : 7.



- a If there are 4 soft chocolates, how many caramels will there be ?
b If there are 35 caramels, how many soft chocolates will there be ?

8. The ratio of "Hard" questions to "Easy" questions in a test is 1 : 4.

a If the test consists of 13 hard questions, how many easy ones are there ?

b A second test consists of 28 easy questions.

- (i) How many hard ones are there ?
(ii) How many questions are there altogether in this test ?



9. Ann and Joan compare the money they earn selling cosmetics.

The ratio of their weekly commission is

Ann : Joan = 2 : 5. (for every £2 Ann earns, Joan earns £5)



- a If Ann earned £20, how much must Joan have earned ?
b If Joan earned £250, how much must Ann have earned ?
c If Ann earned £1000, how much did they earn **altogether** ?

10. A South of Scotland Golf Championship was made up of boys from Dumfries and boys from the Borders.

The ratio of Dumfries boys : Borders boys = 8 : 7.

- If 49 entries were from the Borders, how many were from Dumfries ?
- How many entries were there in total ?



11.



The ratio of new to used cars for sale in a showroom is

new : used = 3 : 5.

- If there are 35 used cars, how many new cars are there ?
- How many cars are there in the showroom ?

12. At a school disco, the ratio of pupils to teachers is 20 : 1.

If 360 pupils turn up at a disco, how many **people** in **total** should there be at that disco ?



13. A wizard is making his secret potion.

Which **strength** of potion does he get if he mixes :-

- 840 grams of powder with 120 ml of liquid ?
- 800 grams of powder with 400 ml of liquid ?
- 600 grams of powder with 800 ml of liquid ?
- 550 grams of powder with 990 ml of liquid ?
- 1080 grams of powder with 240 ml of liquid ?

	Mix in the ratio	
	Strength	Powder : Liquid
	OMG Strong !	7 : 1
	Very Strong	9 : 2
	Medium	2 : 1
	Mild	3 : 4
	Light	5 : 9

14. Tony is making a model aircraft to a scale of 1 : 30.

- His model is 18 cm in height. What is the height of the **real** aircraft, in metres ?
- Another real aircraft is 21 metres long. What length, in cm, should the **model** be ?

15. Share £18 between Alf and Jessie in the ratio 2 : 1 so that Alf gets the **larger** share.

16. Share £175 between Mr Green and Mr Brown in the ratio 3 : 2 so that Mr Brown gets the **smaller** share.



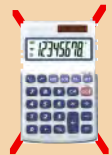
17. The ratio of **cats : dogs : rodents** in a pet shop is **2 : 1 : 5**.

- How many cats are there if there are 4 dogs ?
- How many rodents are there if there are 10 cats ?
- How many cats are there if there are 35 rodents ?
- How many cats and dogs **in total** are there if there are 20 rodents ?
- If there are 3 dogs and 6 cats, how many cats, dogs and rodents are there **altogether** ?



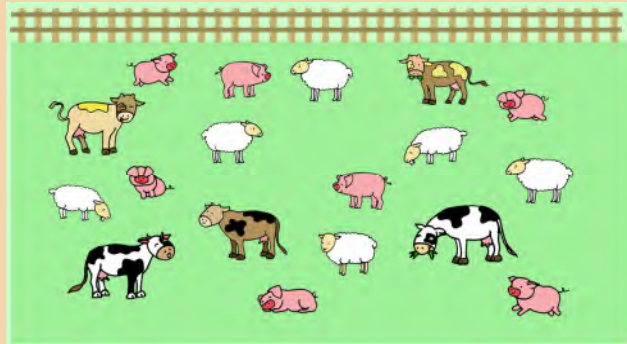
The 3 Я's

Revisit - Review - Revise



1. Write down the ratio

- a cows : sheep.
- b sheep : pigs
- c pigs : other animals.



2.



In Jim's toolbox, he found 8 screws, 11 nuts, 5 bolts and 3 washers.

- a Write down the ratio of bolts : screws.
- b Write down the ratio of washers : nuts.

3. Of a 28 km journey, Tom cycles 16 km and walks the rest.

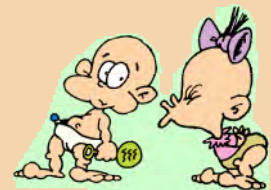
- a Write down the ratio of :- distance cycled : distance walked.
- b Simplify this ratio as far as possible.

4. Simplify the following ratios as far as possible :-

- | | | | |
|-----------|------------|-------------|---------------|
| a 10 : 15 | b 30 : 50 | c 33 : 22 | d 16 : 22 |
| e 55 : 35 | f 35 : 49 | g 39 : 26 | h 23 : 31 |
| i 1.5 : 3 | j 125 : 75 | k 2.4 : 3.6 | l 1000 : 650. |

5. The ratio of baby boys : baby girls in a maternity hospital is 4 : 5.

There are 16 baby boys. How many baby girls are there ?



6. Cans of cola and diet cola were bought for a party.

The ratio of cola : diet cola was 3 : 4.

- a If there were 15 cans of cola, how many cans of diet cola were there ?
- b There were 32 cans of diet cola. How many cans were there **altogether** ?

7.



In April 1996, the ratio of wet days to dry days was 2 : 3.

A weatherman claimed there were 14 wet days in April.

Explain what is wrong with the weatherman's statement.

8. Simplify this ratio as far as possible :- $2\frac{2}{5} : 4$.

CHAPTER 12

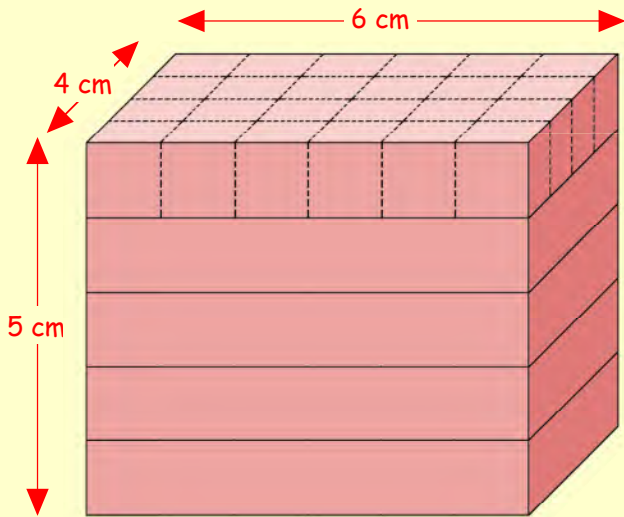
Volume

Volumes of Cubes and Cuboids (Revision)

Be able to calculate the volume of a cube or cuboid using a formula

The **Volume** of a shape is the amount of space it takes up.

Remember how to calculate the **volume** of a cuboid ?



The top layer has 6 rows, 4 deep = $6 \times 4 = 24 \text{ cm}^3$.

5 layers each with $24 \text{ cm}^3 = 5 \times 24 = 120 \text{ cm}^3$.

So there are $6 \times 4 \times 5 = 120 \text{ cm}^3$.

or as a formula :-

$$\text{Volume} = \text{length} \times \text{breadth} \times \text{height}$$

The **Volume** of a cuboid can be found using the formula :-

$$V = L \times B \times H$$

Exercise 1

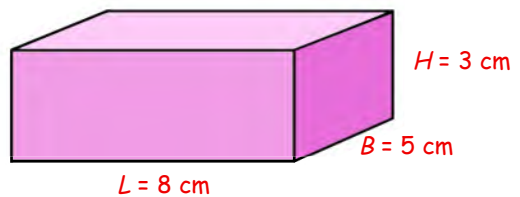
1. Copy and complete for this cuboid :- (You may use a calculator but show all working).



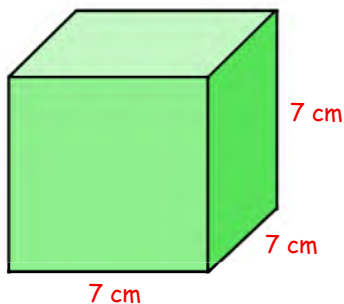
$$V = L \times B \times H$$

$$V = 8 \times 5 \times 3$$

$$V = \dots\dots\dots \text{cm}^3$$



2.

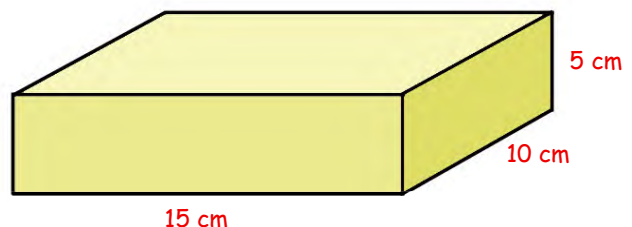


Use the formula $V = L \times B \times H$ to calculate the **volume** of this cuboid.

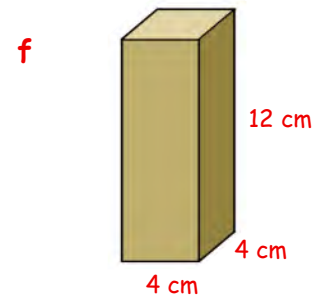
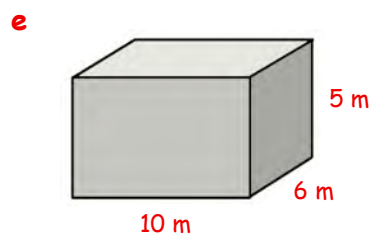
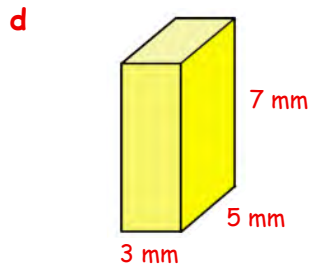
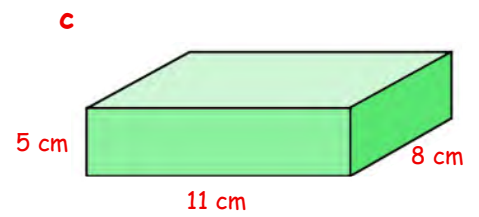
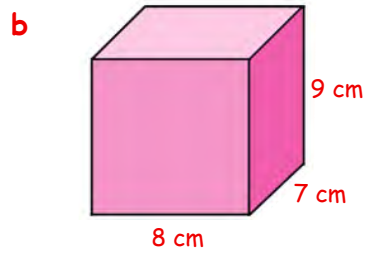
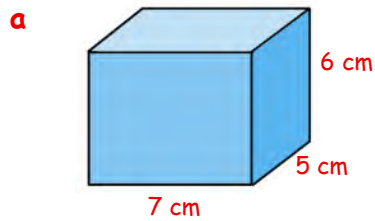
(Show your working).

What is this cuboid better known as ?

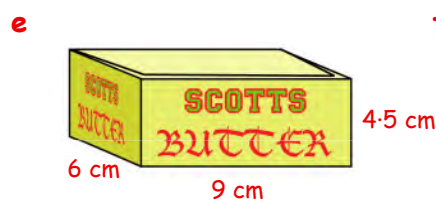
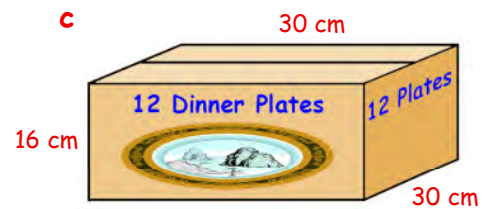
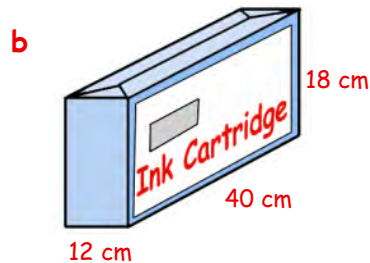
3. Use the formula to calculate the **volume** of this cuboid.



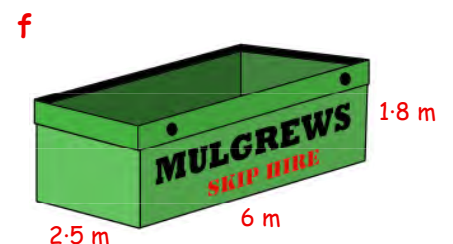
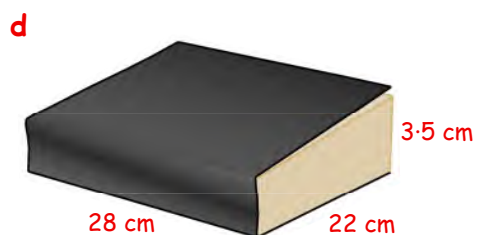
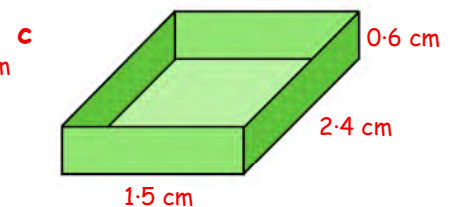
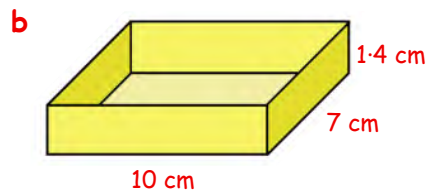
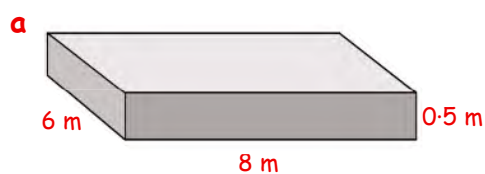
4. Calculate the **volume** of each of the following cuboids :- (Show your working).



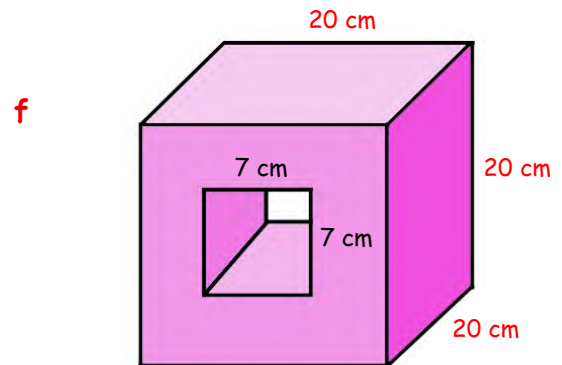
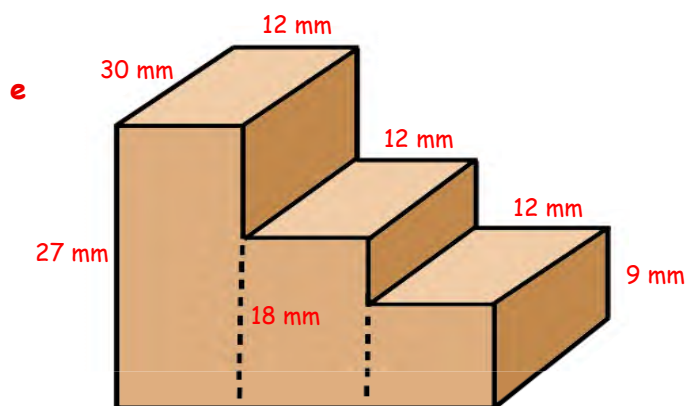
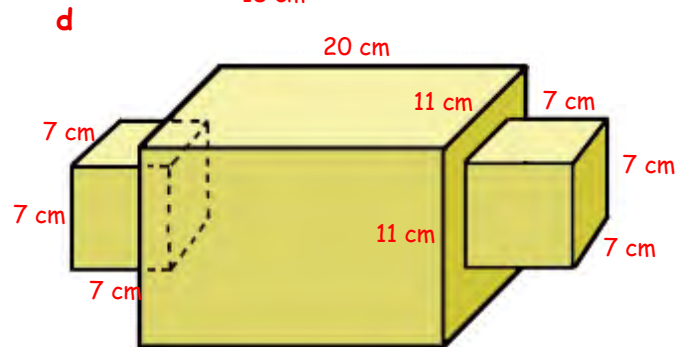
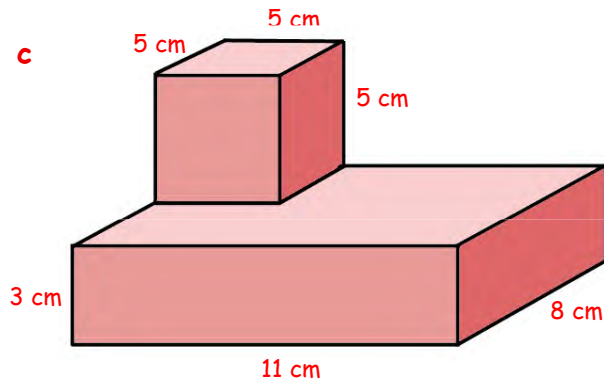
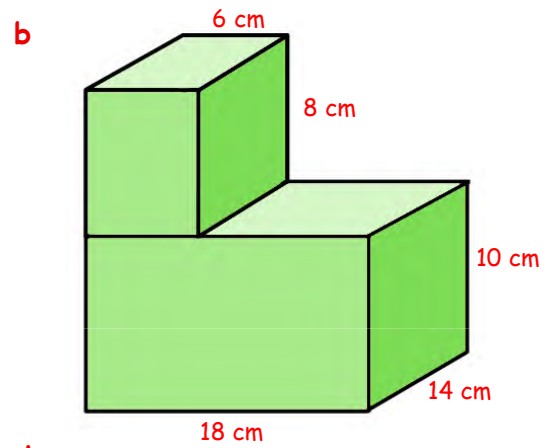
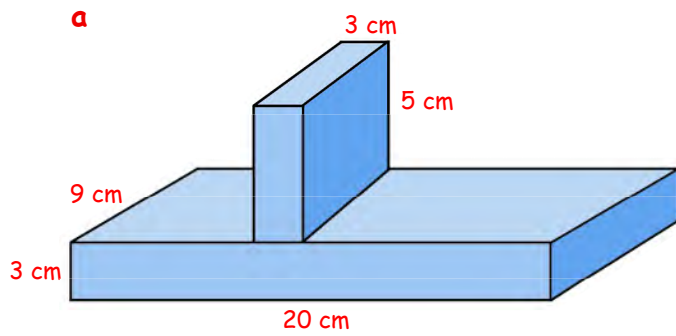
5. Calculate the **volume** of each box :- (You may use a calculator but show all working).



6. Calculate the **volume** of these objects, giving your answer in mm^3 , cm^3 or m^3 :-

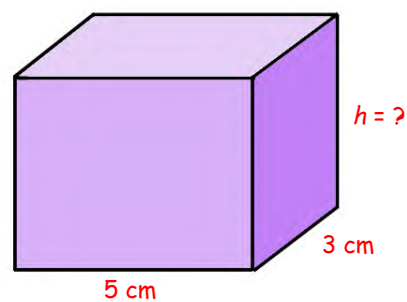


7. By calculating the **volume** of each "block" in the shape, find the **total volume** each time :-

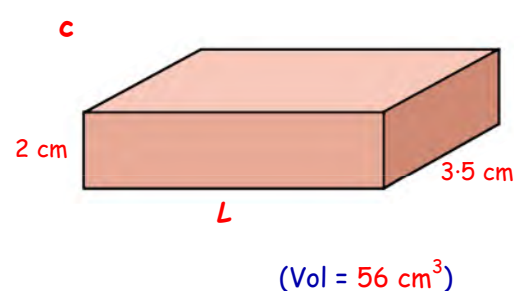
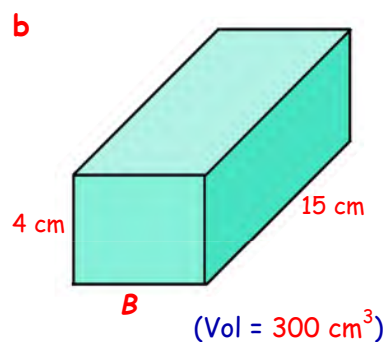
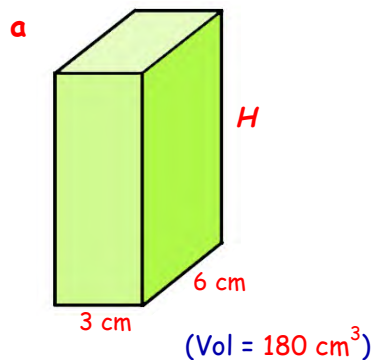


8. The **volume** of this cuboid is 60 cm^3 .

Calculate its **height** (h).



9. Calculate the length of the missing edge in each of the following cuboids :-



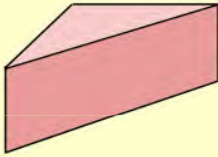
Volumes of Triangular Prisms

Be able to calculate the volume of a Triangular Prism

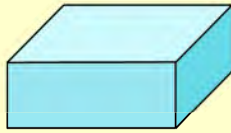
A **Prism** is a solid shape :-

- whose bases (or ends) are **congruent**, and
- whose bases are parallel to one another, and
- whose other faces are rectangles (or parallelograms).

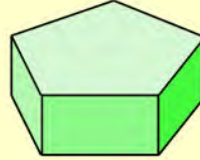
Have the same shape and size.



triangular based prism



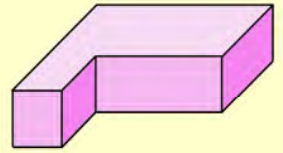
square based prism



pentagonal based prism



circular based prism



irregular shaped prism

To find the volume of any **prism** :-

- calculate the **area** of one of the **parallel faces** (the **base**).
- multiply this by the distance between the parallel faces (the **height**?).

Volume of a **Triangular Prism** is :-

$$\text{Volume} = \text{Area}_{\text{base}} \times \text{height}$$

Example :- The blue base of this prism is an isosceles triangle.

The prism's height is 5 centimetres. Calculate its **volume**.

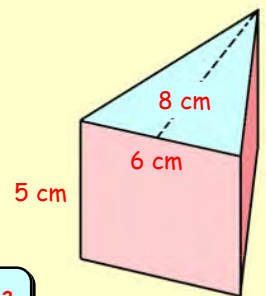
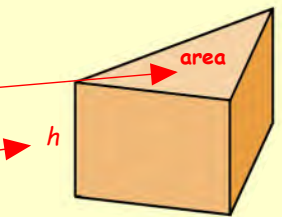
Step 1 :- Find the **area** of the base first :-

$$A_{(\text{blue}) \text{ base}} = \frac{1}{2} \text{ base} \times \text{height} = \frac{1}{2} \text{ of } 6 \times 8 = 24 \text{ cm}^2$$

Step 2 :- Find the **volume** of the prism :-

$$V = A_{\text{base}} \times h.$$

$$V = 24 \text{ cm}^2 \times 5 \text{ cm} = 120 \text{ cm}^3$$



Exercise 2

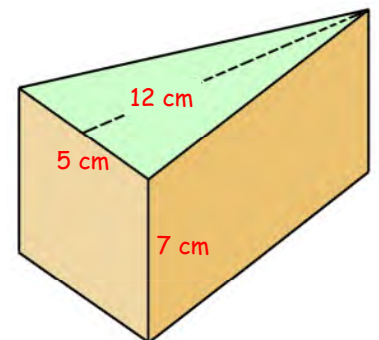
1. Calculate the **volume** of this (isosceles) triangular prism.

Copy and complete :- $A_{\text{base}} = \frac{1}{2} \text{ base} \times \text{height}$

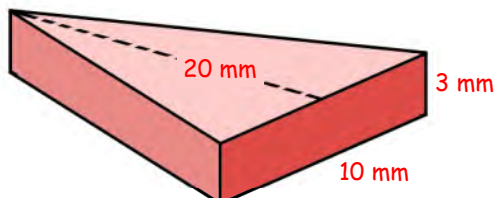
$$= \frac{1}{2} \text{ of } 5 \times \dots = \dots \text{ cm}^2$$

$$\text{Vol} = A_{\text{base}} \times h.$$

$$= \dots \text{ cm}^2 \times 7 \text{ cm} = \dots \text{ cm}^3$$



2.



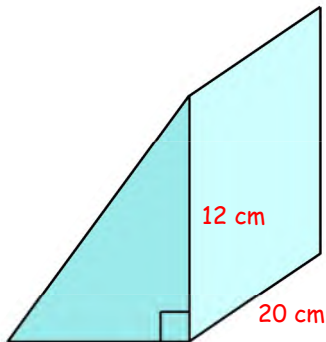
Calculate the **volume** of this (isosceles) triangular prism using the same method shown in question 1.

3. This large Botlerone Bar is an (equiangular) triangular prism.

Calculate its **volume**.



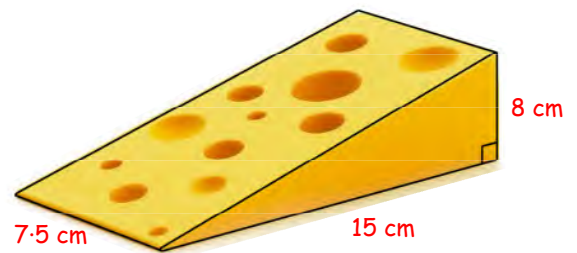
4.



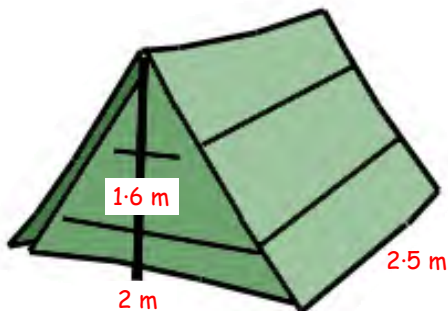
This time, the face of the prism is a **right angled triangle**.

- Calculate the **area** of the triangular face.
- Now calculate the **volume** of the **triangular prism**.

5. Calculate the **volume** of this wedge of cheese.



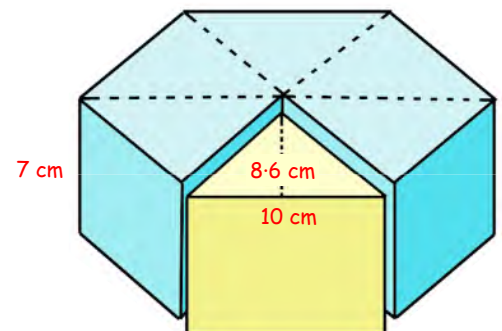
6.



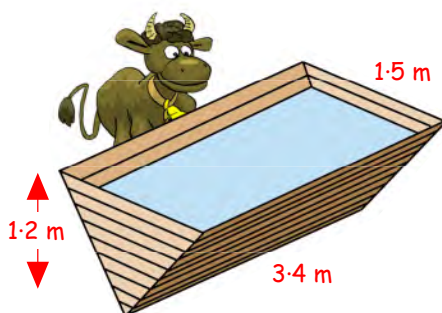
Calculate the **volume** of this 2 person tent.

7. Here is a **hexagonal prism** with one section removed.

- Calculate the **volume** of the yellow prism.
- Now calculate the **volume** of the whole hexagonal prism.



8.



Shown is an animal drinking trough.

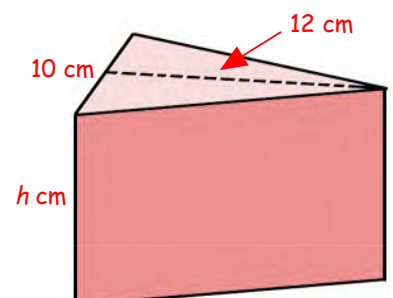
The ends are isosceles triangles.

Calculate the **volume** of water in the trough when it is full.

9. The **volume** of this prism is 510 cm^3 .

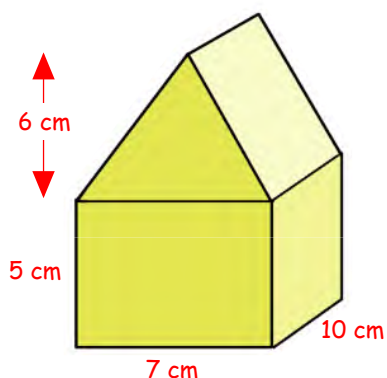
The isosceles triangle on top has base 10 cm and height 12 cm.

- Calculate the **area** of the top triangle.
- Now calculate the **height** of the prism.

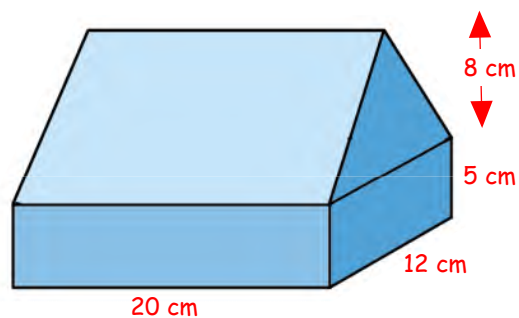


10. Calculate the **total volume** of each of these shapes by considering the individual components.

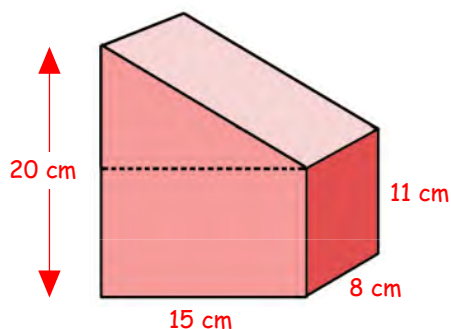
a



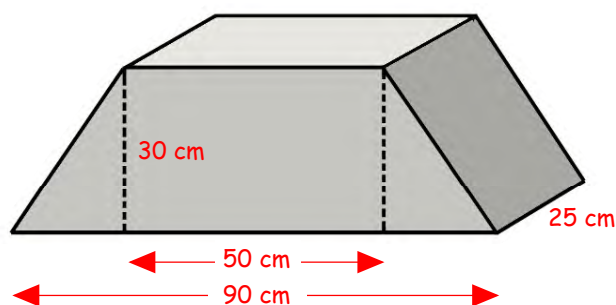
b



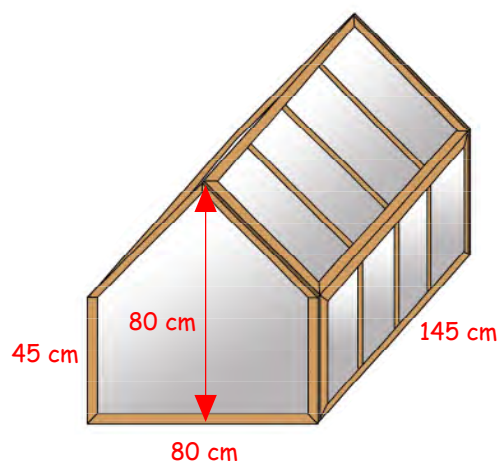
c



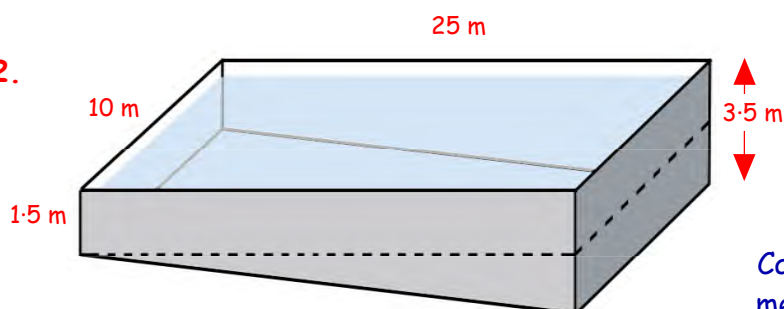
d



11. Sarah keeps her plants in a little mini-greenhouse.
Calculate the **total volume** of space in the greenhouse.



12.



This swimming pool is 25 metres long by 10 metres wide.

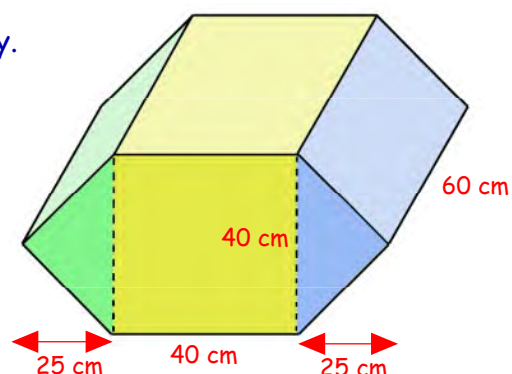
It is 1.5 metres deep at the shallow end and 3.5 metres at the deep end.

Calculate the volume of water in cubic metres in the pool when it is full.

13. Shown is a leather covered soft play toy used in a nursery.

It is in the shape of a **hexagonal prism**.

By calculating the volume of the yellow cuboid and the green and blue triangular prisms, find the **total volume** of the toy.



Liquid Volume - Capacity

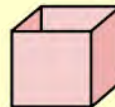
If you have a hollow cube measuring 1 cm by 1 cm by 1 cm, it has a volume of $1 \text{ cm} \times 1 \text{ cm} \times 1 \text{ cm} = 1 \text{ cm}^3$.

If you now fill that small cube with water, it holds 1 cm^3 .

- cm^3 are usually used to define the **volume** of a solid shape.

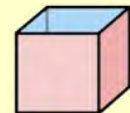
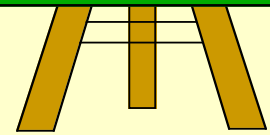
Liquid volume is measured in **millilitres** where $1 \text{ millilitre} = 1 \text{ cm}^3$.

Another name for **liquid volume** is **capacity**. We say the cube has a **capacity** of 1 millilitre (1 ml).



1 cm^3

Be able to find the capacity of a container and convert from l to ml



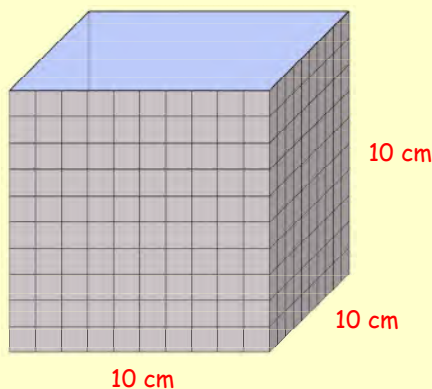
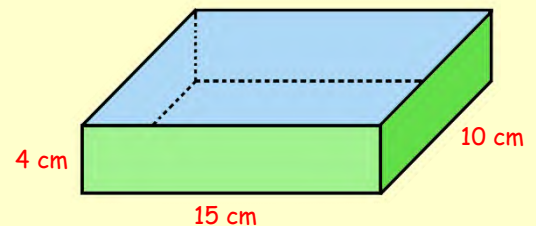
1 ml

Example :- This hollow container is filled with water.

Its volume is $V = L \times B \times H$

$$V = 15 \times 10 \times 4 = 600 \text{ cm}^3$$

Its **capacity** is $C = 600 \text{ ml}$



Note :- This box measures 10 cm by 10 cm by 10 cm

Its volume is $V = L \times B \times H$

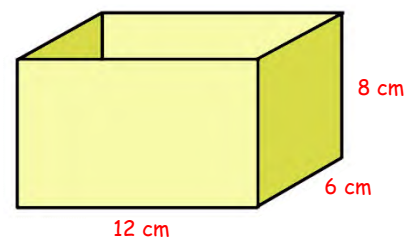
$$V = 10 \times 10 \times 10 = 1000 \text{ cm}^3$$

Its **capacity** is $C = 1000 \text{ ml}$ or 1 litre .

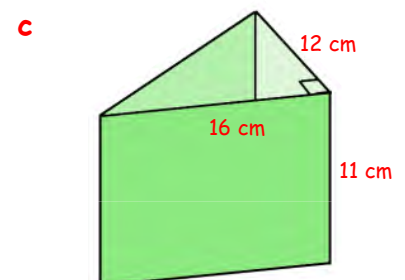
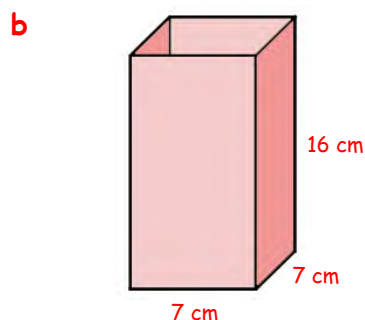
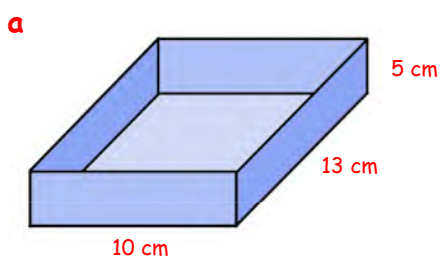
$1 \text{ litre} = 1000 \text{ millilitres}$ ($1 \text{ L} = 1000 \text{ ml}$).

Exercise 3

- Calculate the **volume** of this box in cm^3 .
 - Now write down its **capacity** in **ml**.



- Determine the **capacity** of these three containers :-



3. Change the following from **litres** to **millilitres** :- (Remember :- **1 litre = 1000 ml**).

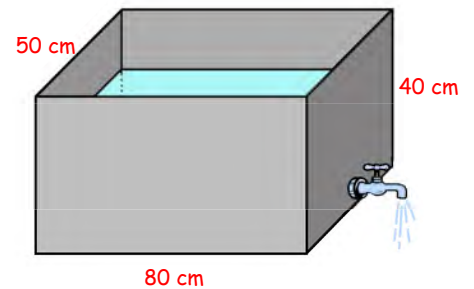
- | | | | |
|-----------------------|-------------------------|-------------------------|--------------------------|
| a 2 litres | b 5 litres | c 8 litres | d 25 litres |
| e 3.2 litres | f 12.75 litres | g 0.9 litre | h 11.234 litres |
| i $\frac{1}{2}$ litre | j $4\frac{1}{2}$ litres | k $1\frac{1}{4}$ litres | l $3\frac{3}{4}$ litres. |

4. Change the following from **millilitres** to **litres** :- (Remember :- **1000 ml = 1 litre**).

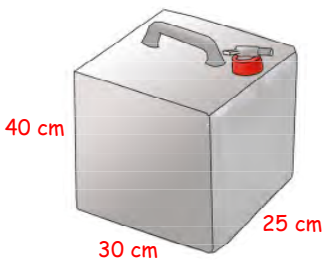
- | | | | |
|-----------|------------|------------|------------|
| a 6000 ml | b 9000 ml | c 15000 ml | d 35000 ml |
| e 2500 ml | f 7250 ml | g 250 ml | h 1300 ml |
| i 4650 ml | j 12620 ml | k 100 ml | l 15 ml. |

5. This cold storage water tank measures 80 cm by 50 cm by 40 cm.

- a Calculate its **volume** in cm^3 .
- b Calculate its **capacity** when full of water :-
- (i) in **millilitres** (ii) in **litres**.



6. Scouts use large containers like this to store their drinking water to allow them to replenish their drinks bottles.

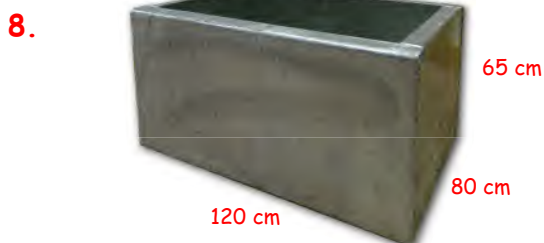
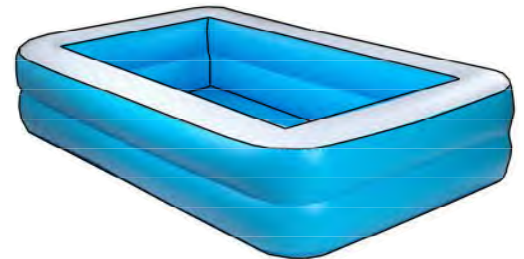


- a Calculate the **capacity** of the large container in **litres**.
- b How many drinks bottles can be filled from a full container ?



7. The inside of this rectangular paddling pool is a cuboid measuring 2.4 m by 1.5 m by 80 centimetres deep.

- a Change 2.4 m and 1.5 m each to centimetres.
- b Calculate the **volume** of the inside of the pool in cm^3 .
- c How many **litres** of water will it need to **half** fill it ?



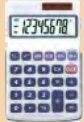
Water pours into this stainless steel storage tank at a rate of **4 litres per minute**.

How long will it take before the tank overflows ?

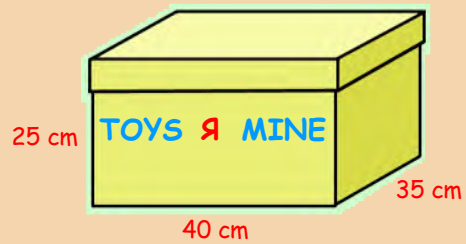
9. Shown is a large storage container with its internal dimensions 3 metres by 4 metres by 12 metres.

Calculate the volume of air inside the container and give your answer in litres. (**Not 144 litres**).

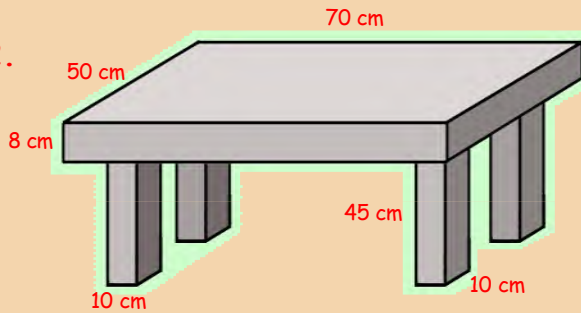




1. Calculate the **volume** of this child's toy-box.



- 2.



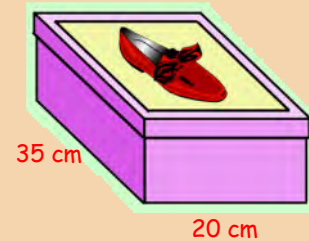
A park installs concrete tables for picnickers.

- The top measures 70 cm by 50 cm by 8 cm.
- Each leg measures 45 cm by 10 cm by 10 cm.

Calculate the **total volume** of concrete used to make a table top and its 4 legs.

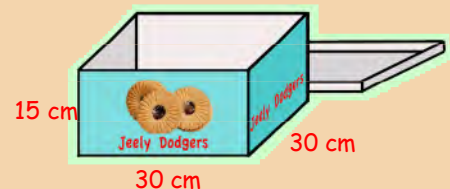
3. The **volume** of this shoe box is 8750 cm^3 .

Calculate the **height** of the box.

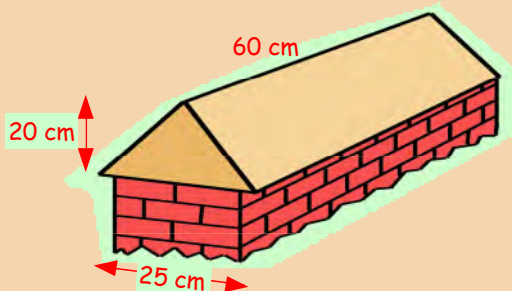


4. Change to litres :- a 2500 ml b 850 ml c 10 ml.
5. Change to ml :- a $4 \frac{1}{4}$ litres b 7.05 litres c $\frac{2}{5}$ litre.

6. a Calculate the **volume** of this metal biscuit tin in cm^3 .
b If, when emptied, it was then filled with sand, what would its capacity be in (i) ml (ii) litres?



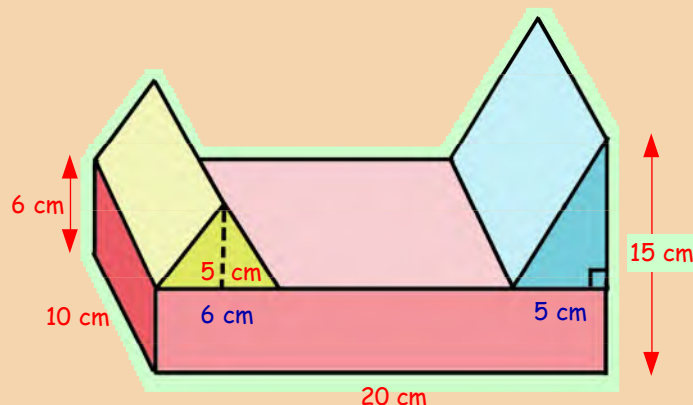
- 7.



These brown tiles are used to finish off the top of a brick wall.

Calculate the **volume** of one of the tiles.

8. Calculate the **volume** of this shape :-



CHAPTER 13



Money

Wages & Salaries

Calculators may be used
in this chapter.

Be able to
calculate
different salary
rates

People earn money and are paid in all sorts of different ways.

Some are paid **hourly**, some **weekly**, some **monthly** and some receive an **annual** (or **yearly**) salary - divided by 12, and paid **monthly**.

Remember - There are **52 weeks** in a **year**; **12 months** in a **year**.
Annual, **per annum** and **p.a.** mean **yearly**.

Example 1 :-

Henri is a chef.

His wage last week was £281.86
for working 34 hours.



- Calculate his **hourly rate** of pay.
- This week he worked 42 hours.
How much did he earn ?

a **Hourly rate** = $\text{£}281.86 \div 34$
= **£8.29**

b This week he earned
 $\text{£}8.29 \times 42 = \text{£}348.18$

Example 2 :-

An assistant gardener gets
paid £9126 per year.

What does that work
out at **per week** ?



Weekly pay

$$\text{£}9126 \div 52 (= \text{£}175.5)$$
$$= \text{£}175.50$$

(note :- you must have 2 decimal figures).

Exercise 1

- Archie is a plumber's mate with a basic rate of pay of £8.75 per hour.
If he works 40 hours every week, how much does he get paid weekly ?



- Olive started a new job as a telephonist.
In her first week, she worked 45 hours at £7.62 per hour.
Calculate her basic pay for this week's work.
 - In her 2nd week, she worked 41 hours.
Calculate her pay for the 2nd week.
 - How much **less** did she earn in the 2nd week ?



3.



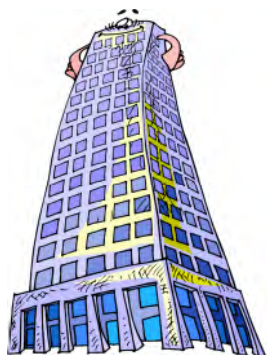
Kate prepared a presentation for her bosses.
She was paid an hourly rate of £7.40.
It took her 14 hours to complete the presentation.
How much did she earn ?

4. Ann is a sales rep and her friend Peter is a researcher.
Ann earns £12.75 per hour whereas Peter is paid £21.20 per hour.
Last week, Ann worked 38 hours and Peter 31 hours.

- a Calculate Ann's pay and Peter's pay for the week.
- b How much **more** did Peter earn than Ann ?



5. Siobhan works in an office earning £11.55 per hour.
How much did she earn in May if she worked :-



week 1 (1st - 5th May)	- 36 hours
week 2 (8th - 12th May)	- 39 hours
week 3 (15th - 19th May)	- 43 hours
week 4 (22nd - 26th May)	- 32 hours

6. a Lee got paid £420.54 for his 43 hours work . Calculate his **hourly** rate.
- b Kira is paid £7.80 per hour. She earned £195.00 last week.
Calculate the number of hours she must have worked.
- c Alf is a painter and decorator.
His hourly rate is £12.80. He earns £576.00 every week.
How many hours does he work in a week ?



7. Sarah works as a cleaner for the Council.
She earned £367.92 last week for her 42 hours.



- a Calculate her **hourly** rate of pay.
- b How much pay is she due for working 37 hours ?

8. During the month of April, Gary worked 36 hours the 1st week, 42 hours the 2nd week, 28 hours the 3rd week and 44 hours the 4th week.
- a How many hours did Gary work altogether in April ?
 - b If his total wage for the month was £1530, calculate Gary's hourly rate of pay.

9. Ian is a joiner and earned £399 last week by working for 38 hours.
Simon is a tailor and earned £466.40 for working 44 hours last week.
Calculate the **hourly** rate of both and say who has the better rate of pay.



10. Dick's monthly pay at Eddy's Electrics is £1246.
Cindy works part-time and her payslip shows she earns £276.25 every week.

Calculate who gets paid more **per annum** and by **how much**.

11. Joe does a part-time milk round each morning. He is paid £39.50 per week. Calculate Joe's **annual** pay.



12. Suzie works on a farm and helps milk the cows. She is paid £9.45 per hour and works 40 hours per week.



- a How much does Suzie earn in a **week** ?
b Calculate her pay **per annum**.

13. Jack and Jill are both surveyors. Jack's monthly pay is £2150. Jill is paid weekly and gets £450.05 per week.



- a Calculate each **annual** salary.
b Who earns **more** and by how much ?

14. Caro is head of sales and gets £24 500 annually. Les is a sales assistant and is paid £1924.25 monthly. Den is a van driver and gets £390.30 weekly.



Of the three, who earns :-

- a most b least ?

15. a Hugh earned £15 600 last year. Calculate his **weekly** pay.
b Joey was paid £14924 last year. Calculate Joey's **weekly** wage.
c Hugh works 40 hours per week. Joey works 35 hours.
Who gets paid more per hour and by how much ?



16. Pat is offered a job as a telephonist working 40 hours per week for £318 per week. She is offered an alternative post at £15 444 annually. She has to work 36 hours per week. Which rate of pay per hour is better, and by how much ?

17. Karen works part-time selling popcorn in the cinema for 25 hours per week. Her annual pay is £5850.

- a How much is her **weekly** wage ? b Calculate her **hourly** rate.



18. Discuss or find out the meanings for each of the following :-

- | | | |
|----------------------------|--|-----------------------------------|
| (i) Hire Purchase | (ii) paid by commission | (iii) overtime |
| (iv) net pay and gross pay | (v) double time, treble time, time and a half, | |
| (vi) income tax | (vii) superannuation | (viii) other money related words. |

19. Investigate different jobs and their various salaries.
Write some conclusions about your findings.

Earning More Money

Be able to
calculate
bonuses and
wage rises

People can earn **extra** money by receiving a **bonus** or a **wage rise**.

Bonus - you receive payment for working extra hard or because the company you work for is doing well.

Wage Rise - obviously means you receive an **increase** in wages, (usually given as a percentage (%) increase).

Example 1 :-

A builder would normally take 8 days to erect a porch, being paid £120 per day.

If he manages to complete the job in 5 days or less, he will get a £500 bonus.

- How much will the builder earn if he takes the entire 8 days ?
- How much will the builder earn if he completes the job in 5 days ?

a	Pay for 8 days	=	8 × £120
		=	£960
b	Pay for 5 days	=	5 × £120
		=	£600
	+ bonus	=	£600 + £500
		=	£1100

Example 2 :-

Last year, a plumber earned £20 000.

This year, he is to receive a 4% pay rise.

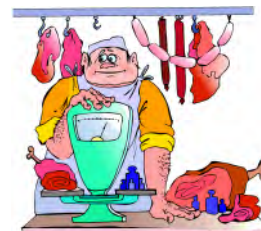
What will his **annual salary** be this year ?

Last year	=	£20 000
Pay Rise	=	$\frac{4}{100} \times £20 000$
	=	£800
New Salary	=	£20 800

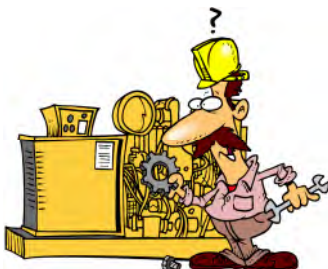


Exercise 2

- A butcher has a monthly wage of £1282.
Last Christmas, he received a bonus of £188.
What was his wage for that month ?



- Jay earns £22 400 per year from a machine parts company.
Last year, with the company doing well, Jay received bonuses of £320 in May, £333 in September and £418 in December.



- Calculate Jay's total bonus money.
- What was his total pay for last year ?

- Steve is a plumber and has won a contract to put sinks into a block of flats.
If he works hard he gets a bonus of £9·80 for every sink he puts in **over** the total of 50.
How much bonus money does he earn for :-

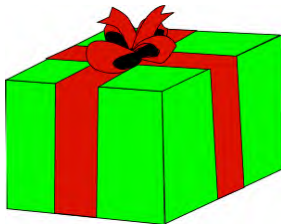
- | | | | | | |
|---|----------|---|----------|---|-------------|
| a | 49 sinks | b | 55 sinks | c | 101 sinks ? |
|---|----------|---|----------|---|-------------|



4. An electrician takes 5 days to wire a new house, being paid £200 per day. If he completes the job in 4 days, he will receive a £300 bonus.

- a How much will the electrician earn if he takes the 5 days ?
b How much will the electrician earn if he completes the job in 4 days ?



5.  A student has a part-time job at Xmas in a shop, wrapping presents and is paid 20p for every parcel. On top of this, for every 20 parcels, she gets a £5 bonus.

How much does she get for wrapping :-

- a 10 parcels b 42 parcels c 101 parcels ?

6. John is a car salesman and is paid £450.20 per week. He also gets a £75 bonus for every new car he sells. In a normal week, John would expect to sell 5 new cars.

- a Calculate John's bonus for selling 5 new cars in a week.
b What is his total pay for such a week ?



7. Calculate these percentages. (No calculator) :-

- a 10% of £84 b 30% of £92 c 70% of £40 d 25% of £104
e 75% of £90 f 5% of £220 g $33\frac{1}{3}\%$ of £51 h $66\frac{2}{3}\%$ of £240.

8. Work out these percentages using a calculator :-

- a 5% of £9 b 15% of £25 c 4% of £1200 d 6% of £250
e 12% of £800 f 12.5% of £700 g 32% of £480 h 21.5% of £40.

9. a Dan earned £16 200 last year as a metal worker. This year he was given a 4% pay rise.

Work out his new **annual** salary.

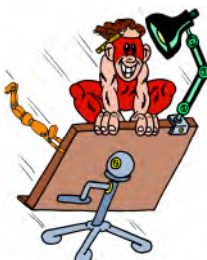
- b Tracy is an insurance clerk and earns £10 200 per annum. The company awarded her a pay increase of 5%.

Calculate her new **annual** salary.

- c Sadia has a weekend job in a hairdressers', earning £25. She asks for and gets a 25% pay rise.

What is her new weekend pay ?



10. a  Darren earns £32 500 **per annum** as a senior draftsman. He is given an 8% pay increase.

What is his new **weekly** pay ?

- b Yaz earns £362 per week as Darren's secretary.

If she is given a 10% increase, how much does she earn **annually** ?

Earning Commission

Be able to
use percentages
to calculate
commission due

Some people, particularly salespersons, receive a **fairly low basic wage**, but can increase their earnings by receiving an additional **percentage** of the **sales** they make as a kind of **bonus** - this is called **Commission**.

A car salesman can earn a **percentage** of the value of each car he sells.

Example 1 :-

Harry gets 5% commission on any vehicle he sells.

Last week he sold £32 000 worth of cars.

Calculate Harry's **commission**.

$$\begin{aligned}\text{Commission} &= 5\% \text{ of } £32000 \\ &= \frac{5}{100} \text{ of } £32000 \\ &= \text{£1600}\end{aligned}$$



Example 2 :-

Ellen sells cosmetics.

She gets a **basic** £800 per month plus **2% commission** on all sales **over** £5000.

Calculate her wage for a week in which she sells £8000 worth of cosmetics.

$$\begin{aligned}\text{Basic Wage} &= £800 \\ \text{Commission} &= 2\% \text{ of } \text{£3000} \\ &= \frac{2}{100} \times £3000 \\ &= £60 \\ \text{Total Wage} &= £800 + £60 \\ &= \text{£860}\end{aligned}$$

$$\begin{array}{r} £8000 \\ - £5000 \\ \hline \text{£3000} \end{array}$$

Exercise 3

- At Autopoint Motors, commission is paid at 3% of sales.

Calculate the **commission** due by selling the following cars :-

a Ford Midi @ £8500

b Citro Max @ £22 400.

- A furniture saleslady at FDS gets 6% commission on any furniture she sells.

If she sold a sofa worth £1820, how much **commission** did she earn ?



- Dougie sells patio furniture. He is paid 12% commission on all sales.

How much **commission** is he due for selling £450 worth of goods ?



- Jenny is an agent for "Cal's Clothing Company". She sells clothes from a catalogue to her friends. She receives 12.5% commission on her sales. Last week she sold £880 worth of goods.

Calculate her **commission**.

5. Stacey is an agent for "Luxury Scenic Tours". She has a monthly pay of £1200. As well as this, she also gets 3.5% commission on all the tours she sells. In June, she sold tours worth a total of £15 000.

- a Calculate her **commission** for June.
b Calculate her total pay for the month.



6.



A booking agency takes 12.5% commission on ticket sales **over** £25 000 for a rock concert.

If ticket sales for the Fruitella's concert reached £40 000, how much commission did the agency make ?

7. Mr Dell sells computers and gets a basic £250 per week plus 6% commission on all sales **over** £6000.

Calculate his wage for a week in which he sells £9600 worth of computers.



8.



Carlos works for a currency exchange agency in Tenerife. He gets a basic 1200 euros per month plus 1.5% commission on all exchanges **over** 7000 euros.

Calculate his wage for a month in which he exchanges :-

- a 6500 euros b 8600 euros c 20 000 euros.

9. Tracy works as a sales rep, earning £1000 per month plus 4% commission on all sales. Edina is the senior sales rep, earning £1200 per month plus 3% of all sales. Last month Tracy had £10 000 sales and Edina had £8000 sales.

Who earned **more** last month, and by how much ?

10. Last month, Alice worked for *SerCo*. She had a sales figure of £40 000. Ben, a *Procon* rep had £60 000 sales. Carron, a *Genco* rep, had £55 000 sales.

- a Who earned most commission ?
b Who earned least ?

Commission on all Sales

Genco gives 6% commission

Procon gives 5% commission

SerCo gives 7% commission

11. Brian is a car salesman. He gets 2% commission on all sales. Last month he earned £500 commission. Calculate what his total sales must have been.



12. Find different occupations that have most of their pay as commission.

Write a short report on these occupations and explain why companies use commission as part of their salary structure.

Earning Extra Money - Overtime

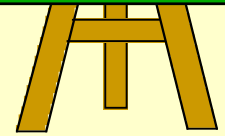
Be able to
calculate
wages, including
overtime

Overtime is when you work more hours than your basic number of hours.

Double Time - you will get paid $2 \times$ your normal rate of pay.

Treble Time - you will get paid $3 \times$ your normal rate of pay.

Time and a Half - you will get paid $1.5 \times$ your normal rate of pay.



Example 1 :-

Kevin is a truck driver with a basic wage of £12.50 per hour.



His overtime pay is paid at **treble time**.

Calculate what he gets for 7 hours **overtime**.

$$\begin{aligned}\text{Overtime} &= 7 \times (3 \times £12.50) \\ &= 262.5 \\ &= £262.50\end{aligned}$$

Example 2 :-

Jessie works in an office for £6 per hour. Her overtime rate is **time and a half**.

Calculate her total pay for a week in which she works a basic 35 hours plus 4 hours overtime.

$$\begin{aligned}\text{Basic Wage} &= 35 \times £6 \\ &= £210 \\ \text{Overtime} &= 4 \times (1.5 \times £6) \\ &= £36 \\ \text{Total Pay} &= £210 + £36 \\ &= £246\end{aligned}$$

Exercise 4

1. Calculate each person's overtime in each of the following :-

- a Johnny is a road digger and his basic rate is £8.00 per hour. Last Sunday, he worked 4 hours overtime at **double time**.
- b Sid is a labourer who is paid a basic rate of £9.40 per hour. On Thursday night, he worked 3 hours overtime at **treble time**.
- c Mr Anwar is a civil engineer who has a basic hourly rate of £36.50. Last week he worked 16.5 hours overtime, at **double time**.
- d Simon is a florist and his normal basic hourly rate is £9.90. He worked 8 hours overtime on a Bank Holiday at **double time**.
- e Jacqui is a customer service worker at a department store. She works at a basic rate of £8 per hour and did 7 hours overtime at **time and a half**.
- f Jeri gets **time and a half** for overtime. Her usual wage is £12.80 per hour. Last week she worked a total of 8 hours overtime.
- g Gary the gas fitter gets £21 per hour (basic rate). Last month his overtime (**time and a half**) was 24 hours.



2. Toby is an apprentice mechanic.
He works a 35 hour week at £9.45 per hour.

a Work out his weekly wage.

Any extra hours he works at night during the week he gets paid as overtime at **double time**.

Last week Toby worked 8 hours overtime.

b What was his overtime pay last week ?

c What was his total pay last week ?



3. Sheila drives an HGV for a basic rate of £8 per hour and works 36 hours per week. Overtime is paid at **treble time**. Last week she worked 4 hours overtime.

What was her total weekly pay ?

4. Buck is a greenkeeper at the local golf club.
His basic hourly rate of pay is £12.50 and he works 30 hours per week.

Next week, for a golf tournament, Buck will need to work 18 hours overtime at **time and a half**.

How much will he be paid for this ?



5. Zara works in the Amazona House at the zoo.
She is normally paid £5.28 per hour and works 42 hours per week.
If she works on a Sunday she gets **time and a half**.

Last Sunday, she worked from 10 am until 3 pm.

How much was she paid for last week ?



6. Zak repairs shoes for a living. He works a 45 hour week for a basic rate of £7.20 per hour.

He also works 6 hours on a Saturday at **time and a half** and 3 hours on a Sunday at **double time**.

Calculate Zak's :-

- a basic earnings b earnings for a Saturday
c Sunday's earnings d total pay for the week.



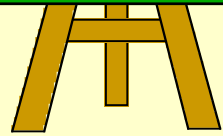
7. Laura is a chief librarian. She gets paid £14 per hour for working a basic 38 hour week, but gets overtime at **time and a half** for week nights and **treble time** on a Saturday.

Set down your working properly to show what Laura gets paid for a week when she works her basic hours, plus the overtime shown on her time-sheet.

Name :- Laura Moore	
Overtime Hours	
Monday	7 pm - 9 pm
Wednesday	6 pm - 9 pm
Friday	6.30 pm - 8.30 pm
Saturday	9 am - noon.

Gross Pay, Net Pay and Deductions

Be able to calculate Gross Pay, Net Pay and Deductions



A typical payslip.

Employee Details				Pay Period	
RBT Thomas Bloggs				YR 44 56 34 F	
Particulars	Units	Rate	Gross	Deductions	Net
Basic Salary	40 hours	£12.50	£500.00	Income Tax	£135.50
Overtime			£112.50	Superannuation	£42.75
Bonus			£105.00	N.I.	£27.60
Total Gross Pay			£717.50	Total Deductions	£205.85
Thomas Bloggs 12 Rose Gardens Twickenham London SW13 9SS				Net Pay £511.65	

Gross pay is the amount that your employer pays you.

Deductions are taken from your gross pay and include items like :-

- **Superannuation** - a type of extra pension for when you retire.
- **National Insurance** - (N.I.) to pay for loss of earnings if you are sick / unemployed.
- **Income Tax** - tax paid to the government to pay for education, health, transport, etc.

Net pay is what you **take home** after deductions are made.

$$\text{Net Pay} = \text{Gross pay} - \text{Deductions}$$

Exercise 5

1. Calculate each **annual net** (take home) **pay** :-

- Steven earns £18 000 **per annum** with deductions of £4870.
- Pia earns £24 500 **annually** and has deductions of £6910.
- Daniel earns £2125 **every month** and has **monthly** deductions of £617.80.

2.



Baz, the barber, has a gross pay of £22 000 per annum. He pays £5880 in deductions.

- Calculate his annual **net** pay.
- What is Baz's **weekly** take home pay?

3. Jack has an annual **gross** salary of £15 200.

He has to pay the following deductions :-

- Calculate Jack's total deductions.
- Calculate his annual **net** pay.

Superannuation : £922.80,
National Insurance (N.I.) : £1216,
Income Tax : £2226.

4.

Income Tax : £92.65,
National Insurance (N.I.) : £60.80
Superannuation : 5% of gross wage



Ellie is a secretary and is paid £635 a week. Her weekly deductions are shown opposite. Calculate her weekly **net** pay.

5. William, as a joiner, has a monthly **net** wage of £1848.

His monthly deductions were £656.

Calculate what his monthly **gross** wage must have been.



6. Calculate the **gross wage** for each of the following :-

- Jenny has a **net pay** of £1124 after her £442 deductions.
- James takes home a pay of £2106 after deductions of £578.
- Alex has deductions of £289 and has a net pay of £908.



7. Ari works 45 hours a week as a brickie, for a basic £14.40 per hour.

- Calculate his gross pay.
His deductions are shown opposite
- Calculate his total deductions.
- Calculate his net pay.

Income Tax : £76.75
National Insurance (N.I.) : £34.95
Superannuation : £35.70
Holiday fund : £20.00



8.

Rio Ferdinand		FP 23 24 65 D	
Earnings :- week ending 12/5/12		Deductions :-	
Basic 42 hrs @ £11.75	£.....	Income Tax	£69.60
Bonus	£35.00	Superan	£29.70
Total Gross Pay	£.....	N.I.	£38.90
		Total Deductions	£.....
		Net Pay :-	£.....

Rio works 42 hours a week for £11.75 per hour. He also receives a £35 bonus from his boss.

His wage slip is shown opposite.

Calculate his **gross** pay, his **deductions** and his **net** pay.



9. Ivan works as a labourer at £11.90 per hour for a 36 hour week.

Last week, he worked 10 hours overtime, paid at **time and a half**.

Last week he paid £84.76 Income Tax, £48.65 N.I. and 8% superannuation (based on his **total** wage).

Calculate his **take home pay** for last week.



10.



Last year, Donny had a gross pay of £76 000, and took home a net pay of £48 765.

He paid £4840 towards his superannuation and paid £4820 in N.I. contributions.

What did he pay in Income Tax last year ?

11. Freda got her wage slip and looked at her deductions which totalled £1145. Her Superannuation was £231 and her Income Tax was £532.

Calculate her N.I. contributions.

12.



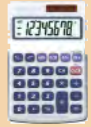
Olivia has a take home pay of £39 880 per annum as a managing director of an IT company.

She pays 6% of her gross pay towards superannuation, which comes to £3480. Her N.I. payments are £4640.

Calculate her **Income Tax** payment.

The 3 Я's

Revisit - Review - Revise



1. a Zoe's salary is £32 520 per annum. How much is her monthly pay ?
 b Barry is paid a fixed salary of £1650 per month. What is his annual salary ?
 c Derek earns £290.50 per week. How much does he earn in a year ?
 d Alex earns £12.40 per hour and works a 40 hour week.
 How much does he earn in a year ?

2. Ali works as a doorman at his cousin's restaurant. He is paid £9.60 per hour.
 a How much will he earn in a week if he works for 48 hours ?
 Last week Ali also worked 6 hours **overtime**, at **time and a half**.
 b Calculate how much he earned for his overtime ?
 c What was Ali's **total** pay for last week ?



3. a  Lennie earns a **gross** pay of £22 524 a year as a mechanic.
 His total deductions are £2376.
 What is his **net** pay ?

- b Joshua ended up with a **net** income of £17 450 per year as a window cleaner.
 His **gross** income was £20 140.
 How much were his deductions ?



4.  Lara has a **gross** income of £23 500 per annum.
 Her total deductions come to 15% of her **gross** pay.
 a How much are Lara's deductions ?
 b What is her **net** income ?

5. Look at Henry's payslip for May 2012.
 Calculate Henry's final **net** pay.

Name :- Henry Jones		Month :- May 2012	
Gross Pay for Month :-		Deductions for Month :-	
Basic	£2095.50	Income Tax	£327.85
Overtime	£463.95	National Insurance	£120.45
Bonus	£250.00	Graduated Pension	£89.60
TOTAL		TOTAL	

6. Lou borrowed £4500 to buy a motorbike.
 He paid back £127.50 a month for 3 years.
 Calculate the **difference** between what he borrowed and what he paid back.

CHAPTER 14

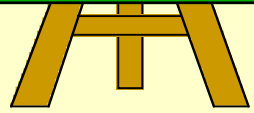


The Circle 2

The Area of a Circle

Calculator may be used in this chapter

Investigating the area of a circle

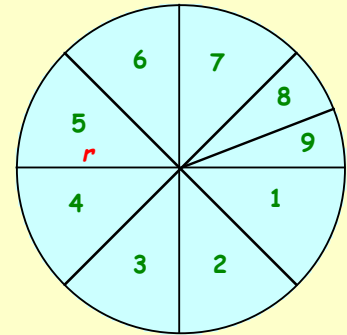
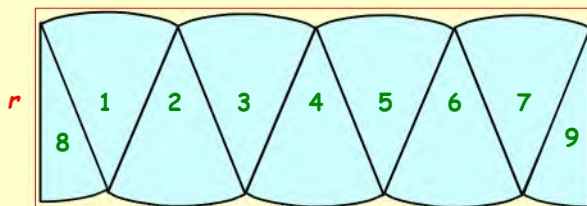


It is difficult to calculate exactly the **area** of a circle because of its curved edge.

Placing a 1 cm clear squared grid on top and counting squares and part squares would work, but it would not be very accurate.

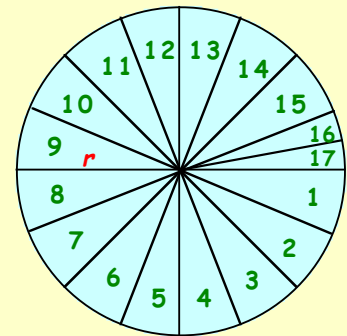
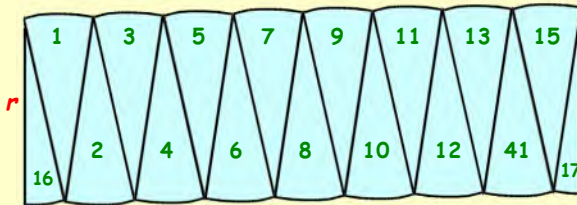
Let us try the following idea to get a good estimate for the area using our magic number π :-

- Cut a circle (with radius r) from a piece of card.
- Divide the circle into **8 parts** as shown and **half** one part.
- Cut the 9 parts out and lay them as shown below :-



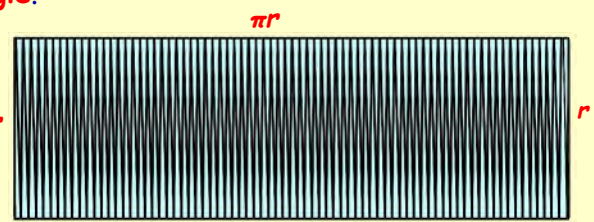
Can you see that our circle has turned into a (rather bumpy) **rectangle** ?

Try doing this again, but this time cut the circle into **16 parts** and half one of them.



Our circle has turned into a better looking **rectangle**.

If you kept doing this with more and more cuts, the circle would look even more like a rectangle.



The **width** of the rectangle is obviously r . (Can you see why ?)

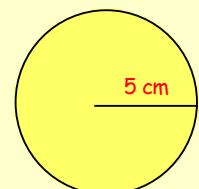
Can you see that the **length** of the rectangle = $\frac{1}{2}$ of the circumference = $\frac{1}{2}$ of $2\pi r = \pi r$.

This means that, since the **area** of a rectangle = $\text{Length} \times \text{Breadth} = \pi r \times r = \pi r^2$.

$$\Rightarrow \text{Area of a circle} = \pi r^2 \quad \text{or} \quad A = \pi r^2$$

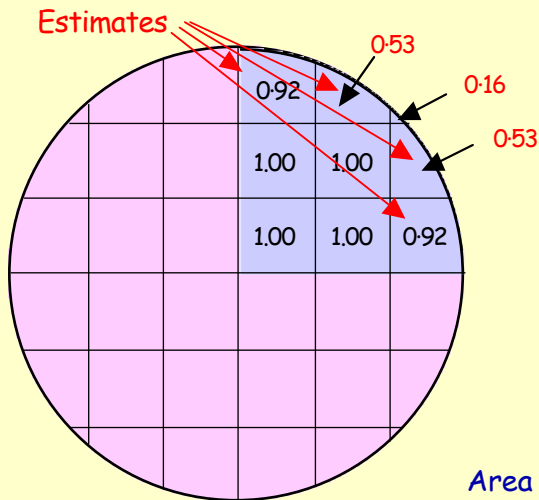
Example :- Calculate the area of this circle with radius 5 cm.

$$\begin{aligned} A &= \pi r^2 \\ \Rightarrow A &= 3.14 \times 5 \times 5 \\ \Rightarrow A &= 78.5 \text{ cm}^2 \end{aligned}$$



The Area of a Circle - A Second Approach

Be able to use a formula to find the area of a circle



The shaded area (quarter circle) has been put onto a square centimetre grid and the area for each part has been **estimated** and given.

The total shaded area (quarter circle) is 7.06 (Check).

This means the **total area** of the circle is

$$7.06 \times 4 = 28.24 \text{ cm}^2$$

There is a formula (or rule) we can use to calculate the area of a circle.

Area generally uses two measurements (... cm x ... cm).

If we find $r \times r$ (or r^2) and multiply it by π ,

we get an answer of $3 \times 3 \times 3.14$ **28.26 cm²**.

(which is nearly the same value as we found by measuring !)

To find the area of a circle we can use $\pi \times r \times r$ or

$$A = \pi r^2$$

Area = 3.14 x radius x radius

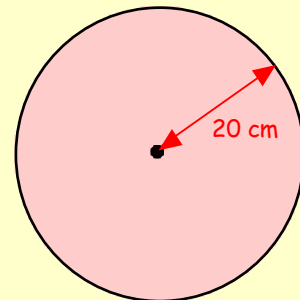
Example :- Calculate the **area** of a circle with radius 20 cm.

$$A = \pi r^2$$

$$\Rightarrow A = 3.14 \times 20 \times 20$$

$$\Rightarrow A = 1256 \text{ cm}^2$$

(square centimetres)



Exercise 1

1. Find the area of a circle with radius 4 cm.

Copy and complete :-

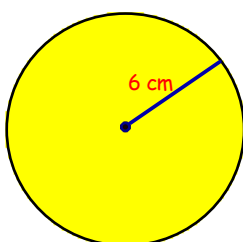
$$A = \pi r^2$$

$$\Rightarrow A = 3.14 \times 4 \times 4$$

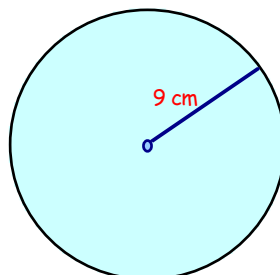
$$\Rightarrow A = \dots\dots \text{ cm}^2$$

2. Calculate the area of each circle below :-
(You **must** set down 3 lines of working)

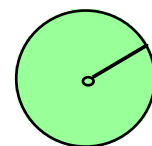
a



b



c



radius = 4.5 cm

Give each answer in this exercise correct to 3 significant figures, where possible.

3. Find the area of each object below : -

a



coin radius = 14.2 mm

b



top crust radius = 12.5 cm

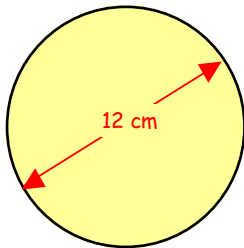
c



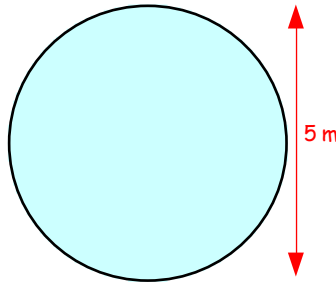
shield radius = 0.5 m

4. Find the area of each circle below : -
(Remember to find the **radius** first)

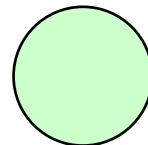
a



b



c



Diameter = 40 mm

5. a The diameter of a golf hole is 10.8 centimetres. Find its **area**.



b



Find the **area** of the circular yoke in this fried egg.
The yoke has a radius of 2.1 cm.

c

Find the **area** of the lid of this drinks carton with diameter 66 mm.



d



This no entry sign has a radius of 0.25 metres.
Find the **area** of the sign.

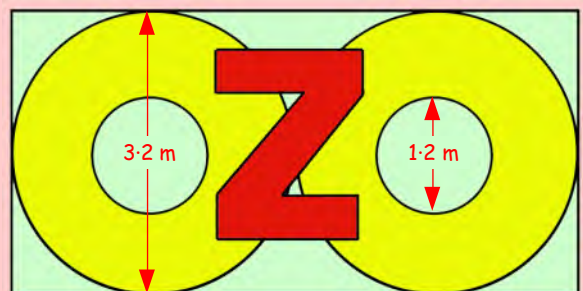
6. The logo for the OZO fish stock cube company is displayed above their main office building.

a Find the area of one large circle.

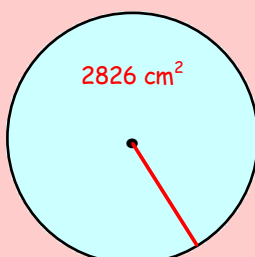
b Find the area of one small circle.

c Find the area of the rectangular frame.

d Find the **total** green area.
(Disregard the "Z" shape).



7.



The **area** of this circle is 2826 square centimetres.

Calculate :- a its radius b its diameter.

Circle Problems

Be able to find
the area of
half/quarter
circles

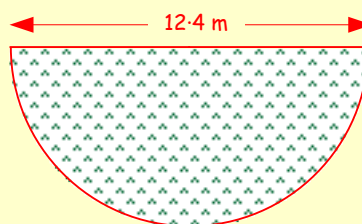
Example :- Calculate the **area** of Sandy's semi-circular lawn.

$$A = \pi r^2$$

$$\Rightarrow A = 3.14 \times 6.2 \times 6.2$$

$$\Rightarrow A = 121 \text{ m (to 3 sig figs.)}$$

Area of **Circle** = 121 m^2
Area of **Semi-Circle** = 60.5 m^2

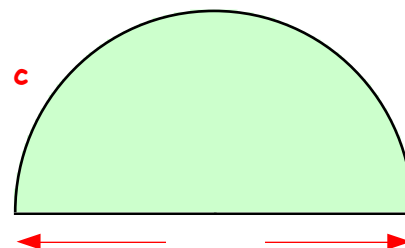
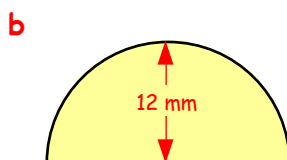
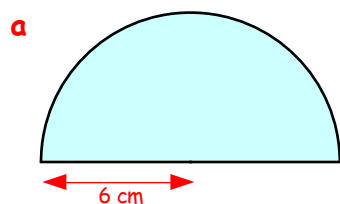


* For a **quarter circle** ... find the area of the full circle and then $\div 4$.

* For a **composite shape** ... find the area of each part and add.

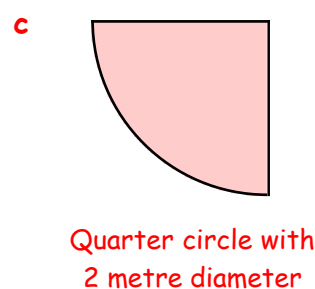
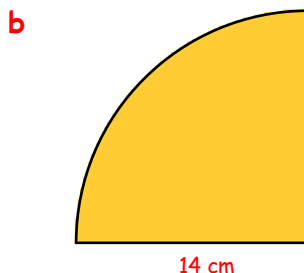
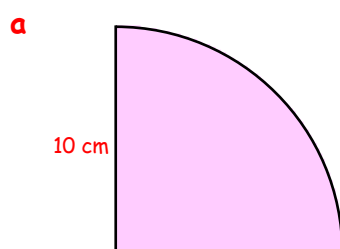
Exercise 2

1. Find the **area** of each **semi-circle** :-



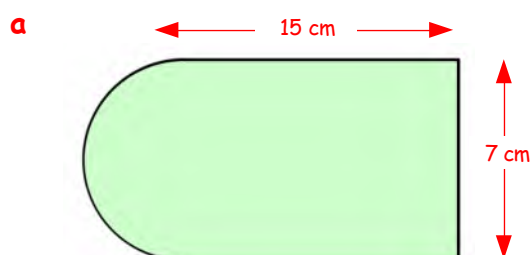
2. Find the **perimeter** of each of the 3 semi-circles shown above.

3. Find the area of each of these shapes :-

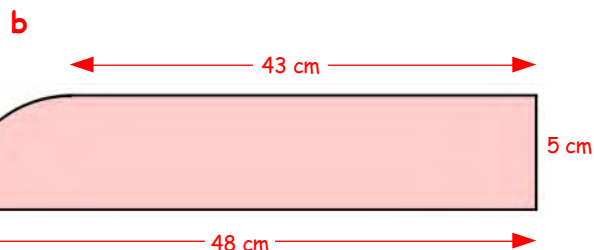


4. Find the perimeter of each of the 3 quarter-circles shown above.

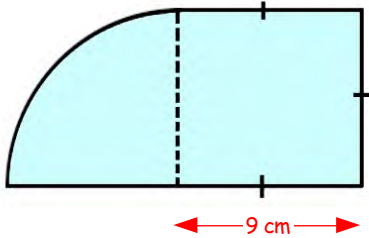
5. For each of the shapes below find :-



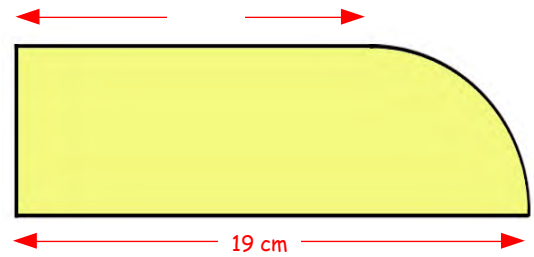
(i) the area (ii) the perimeter.



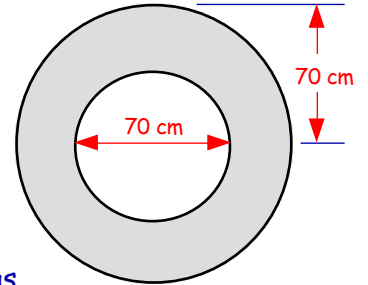
5. c



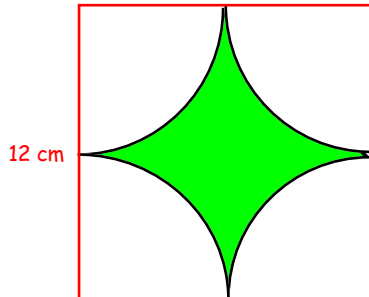
d



6. A hole (70 cm in diameter) has been cut from a flat circular sheet of metal with a 70 cm radius.
Find the area of the metal remaining.



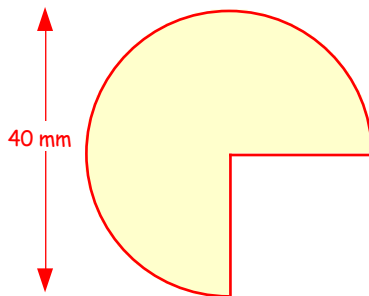
7.



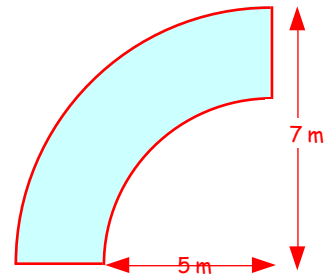
A square with side 12 centimetres has four identical quarter circles cut out from each corner as shown.
Calculate the shaded area.

8. Find the area of each of these shapes :-

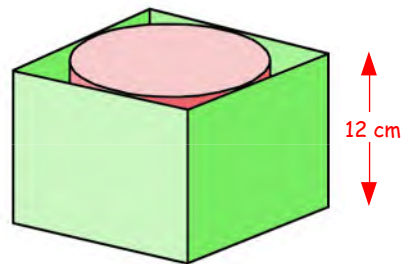
a



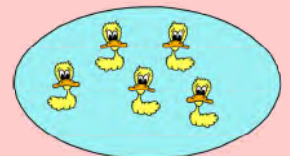
b



9. A circular tin with **circumference** 94.2 centimetres fits exactly into a box in the shape of a cuboid.
Calculate the **diameter** of the cylinder and hence find the **volume** of the tin.



10. A circular duck pond has an **area** of 254.34 square metres.
Calculate the length of edging required to go round the pond.



11.

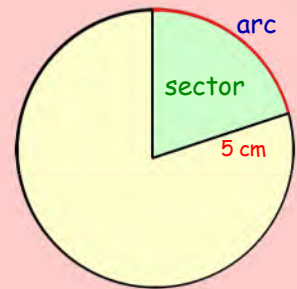


Cindy has a square piece of linen with an area of 6400 cm^2 .
She is trying to make a circular table cloth which has to have an area of at least 5200 cm^2 .
Explain why Cindy cannot make it from her square piece of linen.



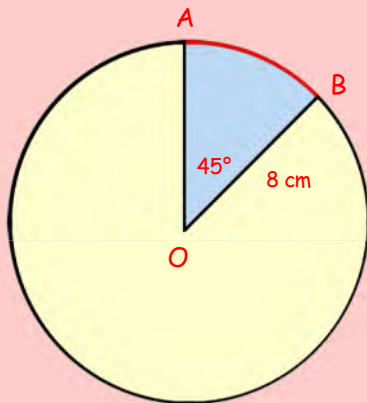
12. The part of this circle shaded green is **one fifth** of the whole circle, radius 5 cm.

- a Calculate the area of the full circle.
- b Now, calculate the area of the green sector.



13. a Calculate the **circumference** of the full circle in question 12.
b Now, work out the length of the red arc.

14.



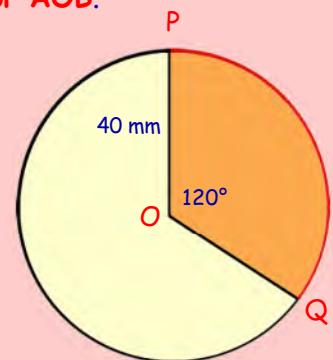
The circle in this question has a radius of length **8 cm**.

The angle between the 2 radii of the sector is **45°**.

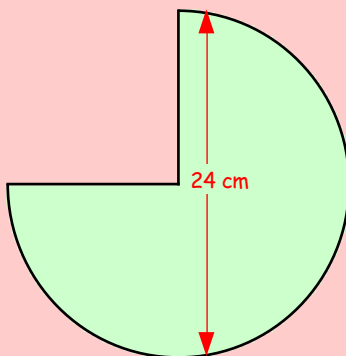
- a What fraction of the circle do you think the blue sector is ?
- b Calculate the area of the full circle.
- c Work out the area of the blue **sector AOB**.
- d Calculate the **circumference** of the full circle.
- e Work out the length of the red **arc AB**.
- f Determine the **perimeter** of **sector AOB**.

15. This circle has a radius of length 40 mm and an angle POQ = **120°**.

- a What fraction of the circle's area is taken up by **sector POQ**.
- b Calculate the area of **sector POQ**.
- c Calculate the length of the **red arc PQ**.



16.



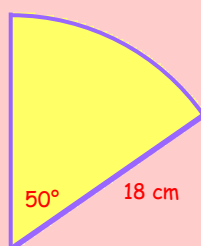
Shown is a sector of a circle with diameter of length 24 cm.

Calculate its **area** and its **perimeter**.

17. A clock pendulum is 30 centimetres long.
It swings through an angle of **40°** as shown.
Calculate the distance through which the end of the pendulum swings.



18.

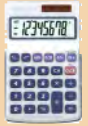


Calculate :-

- a the area of the sector.
- b the perimeter of the sector.

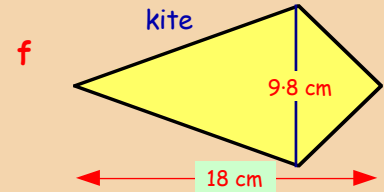
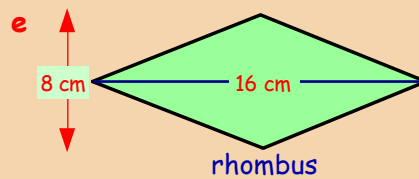
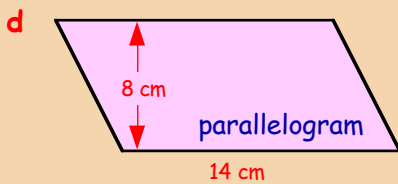
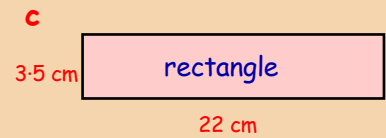
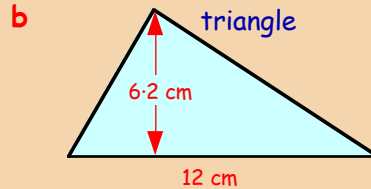
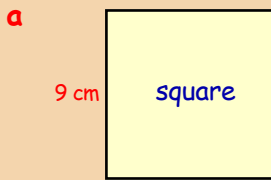
The 3 Я's

Revisit - Review - Revise

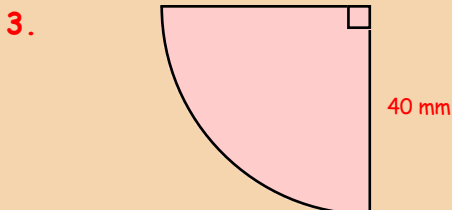
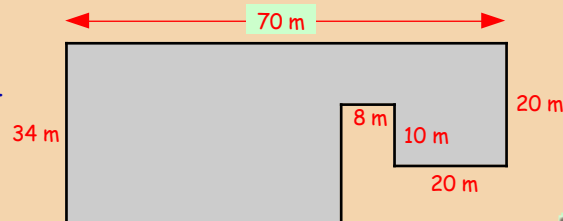


Give all answers correct to 3 significant figures and with correct units.

1. Use the correct formula to calculate the **area** of each of these shapes :-

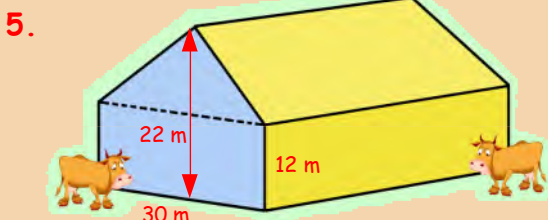


2. The roof of a block of flats is shaped like this :-
Calculate the **area** of the roof.



Work out the **area** of this quarter circle.

4. Visitors to the Monkey House in a zoo are given a stick-on badge.
It has a diameter of 4 centimetres.
Find its **circumference**.



A farmer keeps his cows in this barn.
The rear end of the barn is painted blue.
Calculate the **area** of this end.

6. a A circle has a radius of 12.5 mm. Calculate its **circumference**.
b A circle has a diameter of 200 cm. Calculate its **area**.
c A circle has a circumference of 282.6 cm. Calculate its **diameter** and **radius**.

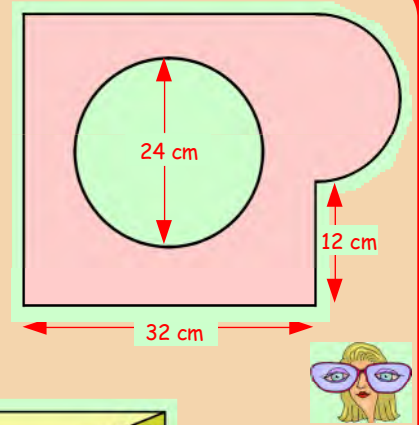
7. Olivia Prentice, the optician, has this logo outside her shops.

It was designed using :-

- a large square with a circle removed from its centre,
- a semi-circle on the top right hand corner of the square.

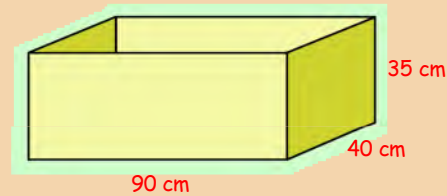
a Write down the length of the **semi-circle's diameter**.

b Calculate the **area** coloured **pink**.

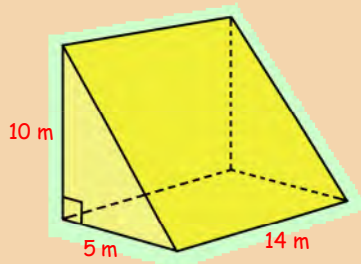


8. a Calculate the **volume** of this tank in cm^3 .

b Write down its **capacity** in litres.



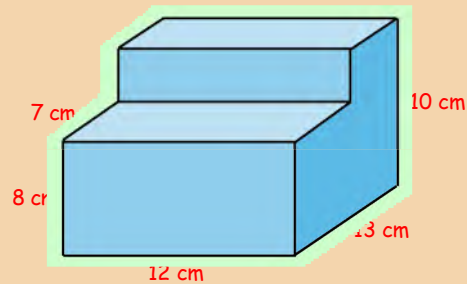
9.



This shape is called a right angled triangular prism.

Work out its **volume**.

10. Calculate the **volume** of this step.



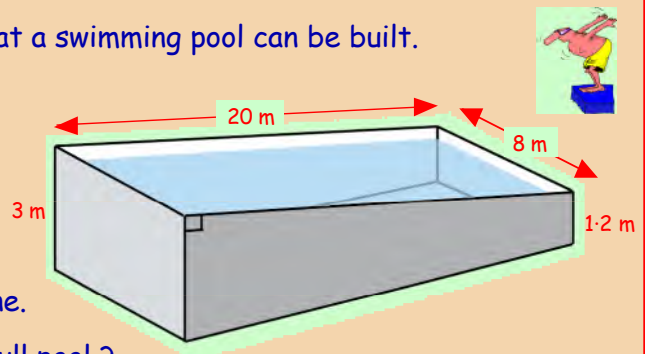
11. A piece of ground has been excavated so that a swimming pool can be built.

There has to be a sloping base, so that one end can be shallow, the other end deep.

a Calculate what **volume** of water this pool will hold when full.

b One cubic metre of water weighs 1 tonne.

What is the weight of water in a half-full pool ?



12. When a Chinese style straw hat is cut open, and flattened it forms a sector of a circle.

The sector of the circle has a radius of 24 centimetres.

Calculate the **area** of straw needed to make the hat.

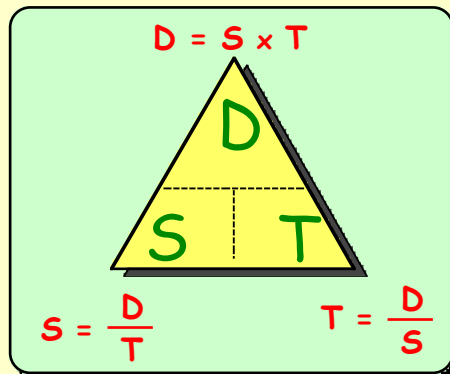


CHAPTER 15

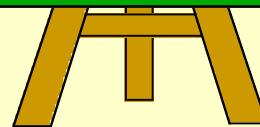
Time, Distance, Speed

Time, Distance & Speed Calculations

In **Book 2b**, you were shown how to use three formulae to help you calculate the **time**, the **distance** or the **speed** for a journey.



Be able to solve time, distance & speed problems using whole units of time



Example 1 :-

Distance 120 miles. Speed 40 mph.

How long did the journey take ?

$$\begin{aligned} T &= D/S \\ &= 120/40 \\ &= 3 \text{ hours} \end{aligned}$$



Example 2 :-

Distance 2616 km. Time 8 hrs.

What was the average speed ?

$$\begin{aligned} S &= D/T \\ &= 2616/8 \\ &= 327 \text{ km/hr} \end{aligned}$$

Example 3 :-

Speed 2 m/sec. Time 15 seconds.

How far did the rabbit run ?

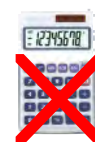
$$\begin{aligned} D &= S \times T \\ &= 2 \times 15 \\ &= 30 \text{ metres} \end{aligned}$$



Exercise 1

1. Use the correct formula to answer these questions :-

- | | | |
|---|---------------------------------------|-------------------------------------|
| a | Distance 96 miles. Time 3 hours. | Find the average speed . |
| b | Distance 420 km. Speed 60 km/hr. | Find the time taken. |
| c | Speed 62 mph. Time 5 hours. | Find the distance travelled. |
| d | Time 15 hours. Distance 3000 miles. | Find the average speed . |
| e | Speed 300 km/hr. Distance 5400 km. | Find the time taken. |
| f | Time 4 minutes. Speed 2.5 metres/min. | Find the distance covered. |
| g | Distance 2500 metres. Speed 50 m/sec. | Find the time taken. |



2. An Apache helicopter flew for 6 hours at a speed of 108 km/hr.

How far did it fly ?



3.



A coach, travelling at a steady speed, took 7 hours to cover the 434 kilometres from Glasgow to Coventry.

What was its speed ?

4. Julie can type 40 words per minute.

How many hours will it take her to type a manuscript containing 4800 words ?



5.



A holiday jet took off from Edinburgh Airport at 1135 and arrived at Faro Airport, Portugal at 1535.

If the jet flew for 1328 miles, what was its average speed ?

6. A tortoise travelled 4 metres over rough terrain, moving at an average speed of 50 cm/minute.

How long did it take the tortoise to complete its journey ?



7.



A hot air balloon, travelling at an average speed of 400 metres per minute was in the air for only 50 minutes when it had to abandon its journey.

How far had it managed to travel ?

8. Mr Baines, the maths teacher, jogs to school every day. It takes him 10 minutes. The distance from his house to the school is 1.4 kilometres.

- a Calculate Mr Baines' average speed, in metres per minute.
- b If he takes his car to school he can get there five times quicker.

How long does his car journey take ?

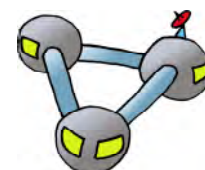


9.



A bird migrated from Scotland and flew 1470 miles over a 6 day period. If a steady speed was maintained, how far did it travel each day ?

10. A communications satellite orbited 74 400 km around the Earth. If it took 6 hours to complete the orbit, what was the satellite's average speed ?



11. Old Joe did a 6 kilometre charity walk and completed it in 5 hours.

- a Calculate Joe's speed in metres per hour.
- b How far did Joe walk in 15 minutes ?



12. A 25 centimetre icicle melts away in half an hour.

- a Calculate its average melting speed in cm/hr.
- b How long would it take a 1.5 metre icicle to melt at this rate ?



13. John left Dundee at 10.55 pm on Saturday and travelled the 350 miles to London at an average speed of 70 mph. When exactly, did John arrive in London ?



TDS Problems Involving Half and Quarter Hours

Be able to solve
TDS problems
involving half hour/
quarter hour times

So far, we have only dealt with Time-Distance-Speed problems which have been restricted to having time as a whole number of units.

We now look at problems with **half hour** and **quarter hour** time intervals.

1 hour 30 minutes is $1\frac{1}{2}$ hrs or **1.5 hrs** (not 1.30 hrs)

2 hours 15 minutes is $2\frac{1}{4}$ hrs or **2.25 hrs** (not 2.15 hrs)

Example 1 :-

Speed 60 mph.

Time 1 hr 30 mins.

How far is the journey ?

$$\begin{aligned} D &= S \times T \\ &= 60 \times 1.5 \\ &= \mathbf{90 \text{ miles}} \end{aligned}$$



Example 2 :-

Distance 45 km.

Time 2 hr 15 mins.

What's the average speed ?

$$\begin{aligned} S &= D/T \\ &= 45/2.25 \\ &= \mathbf{20 \text{ km/hr}} \end{aligned}$$



Example 3 :-

Distance 375 miles.

Speed 150 mph.

How long did this flight take ?

$$\begin{aligned} T &= D/S \\ &= 375/150 \\ &= 2.5 \text{ hrs} \\ &= \mathbf{2 \text{ hrs } 30 \text{ mins}} \end{aligned}$$



Exercise 2



1. Use the correct formula to answer these questions :-

- | | |
|--|---|
| <p>a Walking at 4 mph for $1\frac{1}{2}$ hours.</p> | <p>Find the distance travelled.</p> |
| <p>b Cycling for 45 miles at 18 mph.</p> | <p>Find the time taken.</p> |
| <p>c Going 315 miles in 3 hours 30 minutes.</p> | <p>Find the average speed.</p> |
| <p>d Sailing at 18 km/hr for 3 hours 15 minutes.</p> | <p>Find the length of the journey.</p> |
| <p>e Flying at 240 km/hr over 1260 km.</p> | <p>Find the time taken.</p> |
| <p>f Travelling 464 km in 7 hours 15 minutes.</p> | <p>Find the average speed.</p> |

2. A train, travelling at a steady speed of 120 mph took $6\frac{1}{2}$ hours to complete its journey.

How far had it travelled ?



3. A marathon runner took 3 hours 30 minutes to cover 28 miles. What was his average speed ?

4. Donna swam 270 metres at an average speed of $6\frac{3}{4}$ metres per second. How long did she take ?



5. A plane flew for 150 miles at a speed of 300 mph.
For how long was it in the air ?



6. Tony went on a short jog for $\frac{1}{4}$ of an hour at a speed of 10 km/hr.
What distance did he cover in that time ?



7. A hot air balloon travelled 15 miles in 15 minutes.
What was its average speed in mph ?



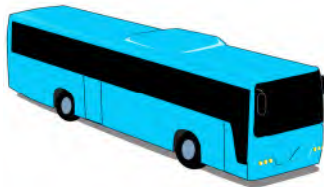
8. A space ship averaged 2400 km/hr for 9 hours 30 minutes.
What distance did it travel ?



9. A snail slithered 170 cm in four and a quarter hours.
What was its average speed in cm/hr ?



10. A coach travelled the 260 miles from Manchester to Edinburgh
at an average speed of 40 mph.
How long did that take ?



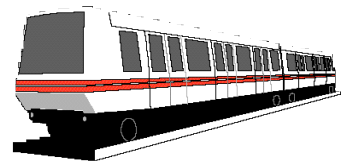
11. Tim and Mary towed their caravan at a steady speed of 52 km/hr
for a journey which took 8 hours 15 minutes.
How far had they journeyed ?



12. A hill walker is crossing the valley at an average speed of 7 km/hr.
How long will it take him to walk the whole length of the valley
which is $17\frac{1}{2}$ km long ?



13. A train left Inverness at 1415 and arrived at the Borders at 1730.
If it had travelled 364 km, what speed did it average ?



14. A car ferry travelled 2.5 km in 15 minutes.
What speed (km/hr) was it travelling at ?



15. Terry leaves home and takes 30 minutes to walk to school each day.
If he walks at 4.5 km/hr, how many metres from the school is Terry's house ?



16. Donald drove for 189 kilometres at a speed of 42 km/hr.
Evelyn drove for 221 kilometres at a speed of 52 km/hr.
Whose journey took longer and by how much ?



Converting Hours/Minutes => Decimal Times

Be able to change hours and minutes into decimal times

In the last exercise you learned :- $\frac{1}{2}$ hour = 0.5 hr and $\frac{1}{4}$ hour = 0.25 hr.

We now look even further into decimal times, so that journeys can take say, 2 hours and 20 minutes.

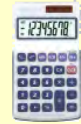
Changing **Hours and Minutes** => **Decimals**

Examples :-

45 minutes is $\frac{45}{60}$ of an hour = $45 \div 60$ = **0.75 hr**

12 minutes is $\frac{12}{60}$ of an hour = $12 \div 60$ = **0.2 hr**

2 hrs 21 minutes is $2 + \frac{21}{60} = 2 + (21 \div 60)$ = **2.35 hrs**



RULE :- to change minutes to a decimal fraction of an hour => $\div$ by 60

Exercise 3

1. You can use your calculator to change the following to decimals :-

a 6 minutes = $\frac{6}{60}$ hour (= $6 \div 60$) = ... hour

b 36 minutes

c 24 minutes

d 42 minutes

e 12 minutes

f 9 minutes

g 54 minutes

h 33 minutes

i 18 minutes.

2. Use your calculator to change these times to decimals giving your final answers correct to 2 decimal places :-

a 40 minutes

b 8 minutes

c 58 minutes

d 20 minutes

e 50 minutes

f 13 minutes

g 70 minutes

h 105 minutes.

3. Use your calculator to change the following times to decimals :-

a 3 hours 45 minutes = $3 + \frac{45}{60} = 3 + (45 \div 60)$ = ... hours

b 1 hr 36 mins

c 5 hrs 24 mins

d 7 hrs 33 mins

e 4 hrs 51 mins

f 2 hr 18 mins

g 9 hrs 21 mins

h 3 hrs 20 mins

i 10 hrs 3 mins.

4. A plane flies at 360 km/hr for 18 minutes.

How far does it fly in that time? Copy and complete :-



$$D = S \times T$$

$$= 360 \times \frac{18}{60}$$

$$= 360 \times 0.3...$$

$$= \dots \text{ km}$$

5. A school bus goes at an average speed of 30 mph. How far will it cover in :-

a 36 minutes (= $30 \times \frac{36}{60}$)

b 45 minutes

c 40 minutes

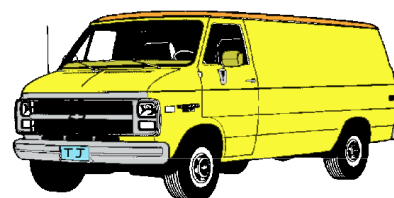
d 18 minutes

e 24 minutes

f 54 minutes ?



6. Calculate the distance travelled each time :-
- A jet ski going at 40 km/hr for 36 minutes.
 - A van speeding at 75 mph for 20 minutes.
 - A truck crawling up a hill at 10 km/hr for 21 minutes.
 - A 747 jet flying at 420 mph for 10 minutes.
 - A horse and cart moving at 8 km/hr for 45 minutes.



7.



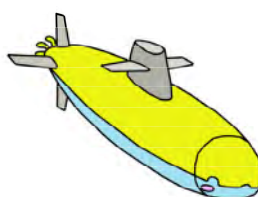
Simon and Beth take turns at the wheel :-

Simon drives at 48 km/hr for 45 minutes.

Beth drives at 60 km/hr for 35 minutes.

Who drove further, Simon or Beth and by how much ?

8. A submarine sailed underwater at 20 km/hr for 4 hours 48 minutes.
How far did it travel ?



Show your working like this :-

$$\begin{aligned} D &= S \times T \\ &= 20 \times \left(4 + \frac{48}{60}\right) \\ &= 20 \times 4.8 \\ &= \dots \text{ km} \end{aligned}$$

9. For each of the following, calculate the distance travelled :-
- A flying saucer flies at 4080 m.p.h. for 10 hours 36 minutes.
 - A rickshaw goes at 5 mph for 1 hour 12 minutes.
 - A marathon runner runs at 9 km/hr for 2 hours 20 minutes.
 - An aerial tram moves at 65 km/hr for 1 hour 54 minutes.

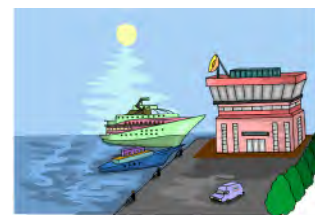


10. A cruise ship, coming into the docks, moves a distance of 3 kilometres in 36 minutes.

Calculate its speed in km/hr.

Show your working like this :-

$$\begin{aligned} S &= D/T \\ &= 3 \div \frac{36}{60} \\ &= 3 \div 0.6 \\ &= \dots \text{ km/hr} \end{aligned}$$



11. Find the **average speed** for each of these questions :-

- A helicopter flies 140 miles in 42 minutes.
- A fire engine travels 7 kilometres in 6 minutes.
- A jet covers 315 miles in 45 minutes.
- A truck travels 42 miles in 36 minutes.
- A tug boat covers 12 km in 2 hours 24 minutes.
- A bulldozer travels 14.8 miles in 3 hours 42 minutes.
- A rocket flies 6120 miles in 5 hours 6 minutes.
- An electric golf cart travels 22.4 miles round the course in 3 hours 12 minutes.



Converting Decimal Times => Hours/Minutes

Be able to
change decimal
times into hours
and minutes

In the last exercise you learned a simple rule for changing hours and minutes into decimal form.

RULE 1 :- to change minutes to a decimal fraction of an hour => $\div$ by 60

When using a calculator to find the time taken for a journey, the answer might appear as a decimal, like 0.65 hrs. There is an easy way of changing this to minutes.

RULE 2 :- to change a time in decimal form back into minutes => $\times$ by 60

Decimals => Minutes

Examples :-

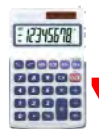
$$0.7 \text{ hr} = (0.7 \times 60) \text{ mins} = 42 \text{ minutes}$$

$$0.75 \text{ hr} = (0.75 \times 60) \text{ mins} = 45 \text{ minutes}$$

$$4.2 \text{ hrs} = 4 + (0.2 \times 60) \text{ mins} = 4 \text{ hours } 12 \text{ minutes}$$

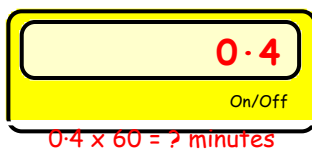


Exercise 4

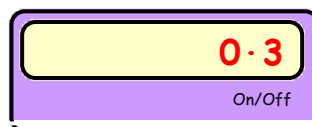


1. Change the following calculator display times (decimals) to minutes :-

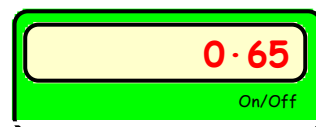
a



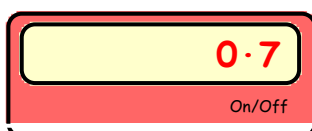
b



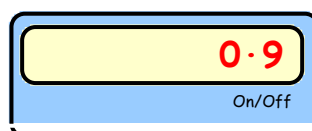
c



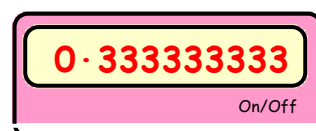
d



e



f



2. If you want to change 3.8 hours into hours and minutes :-

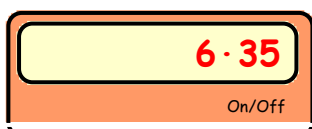
- Leave the hours as they are (3 hours)
- Multiply the 0.8 by 60 => minutes => Answer 3 hrs mins ?

3. Use the same method as question 3 to change the following times to hours and minutes :-

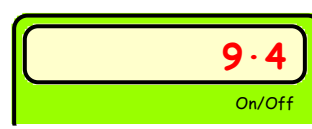
- a 6.3 hours = 6 hour + (0.3 $\times$ 60) minutes = 6 hours ... minutes.
- b 2.65 hours c 4.5 hours d 3.85 hours e 1.6 hours
- f 8.66666 hours g 7.9 hours h 1.833333 hours i 15.2 hours.

4. Write the following calculator (decimal) times in hours and minutes :-

a



b



c



5. A steam boat covers 96 kilometres at 20 km/hr.

- Calculate the time taken in hours. ($T = D/S$) (as a decimal).
- Change your answer to hours and minutes.



6. A tram travelled 38.4 kilometres at an average speed of 18 km/hr.



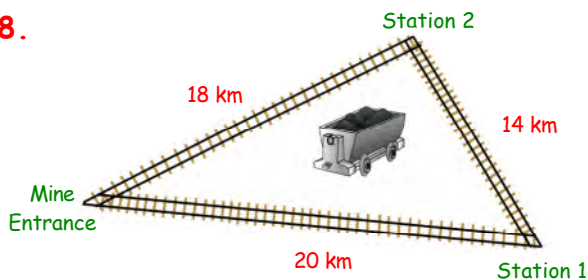
- Calculate how long it took (as a decimal).
- How long did it take in hours and minutes.

7. Calculate the time taken (as a decimal) for each of the following, and then give your answer in hours and minutes :-

- A train journeys 518 miles at an average speed of 140 mph.
- A tractor travels 14 kilometres at an average speed of 42 km/hr.
- A police car, during a chase, travels 28 miles at an average speed of 80 m.p.h.
- A Thames Valley swimmer covers 16.5 miles at an average speed of 6 mph.



8. Shown is a plan of a rail track in a coal mine.



The trucks on the rails average a speed of 8 km/hr.
How long, in hours and minutes, does a coal truck take :-

- to travel from the entrance to station 1 ?
- to travel from station 1 to station 2 ?
- to make one complete circuit of the track ?

9. Linford covers a distance of 350 metres in 50 seconds.

- What is Linford's speed in metres per second ?
- Copy** this example and **complete** it to show how to change Linford's speed from **metres per second** to **km/hr** :-



- step 1** Change the speed to metres per minute, then metres per hour
 $\Rightarrow 7 \text{ m/sec} \Rightarrow 7 \times 60 = 420 \text{ m/min} \Rightarrow 420 \times 60 = 25\,200 \text{ m/hr.}$
- step 2** Change the metres to kilometres ($\div 1000$)
 $\Rightarrow 25\,200 \text{ m/hr} \Rightarrow 25\,200 \div 1000 = \dots\dots \text{ km/hr.}$

10. Change these speeds from metres per second to km/hr :-

- 20 m/sec
- 50 m/sec
- 400 m/sec
- 12.5 m/sec.

11. Which is faster :-

- a cheeta who can run at 14 m/sec,
 - or a tiger who can move at 50 km/hr,
- and by how much ?



Time, Distance, (& Speed) Graphs

Be able to interpret and do calculations using a TDS graph

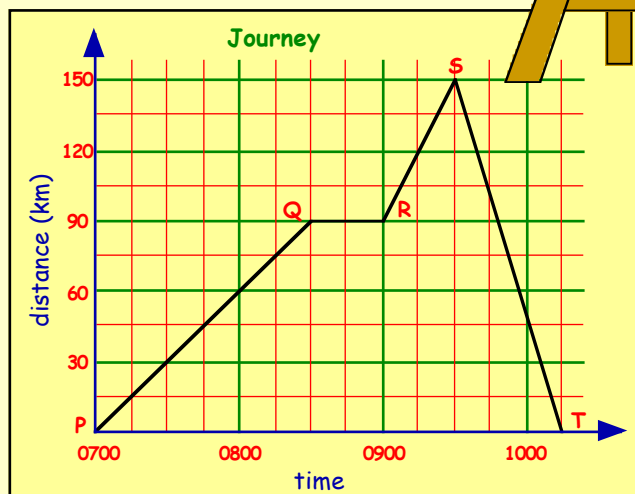
The graph opposite shows an outward journey from P → Q → R → S, then a return home from S → T.

We can answer questions about the journey from the graph, including finding the speed at various stages.

You can see that after an hour and a half, a stop of half an hour was made at Q.

Notice also that since the line RS is **steeper** than the line PQ, the speed was **greater** for that part.

We can calculate the **speed** at various stages as follows :-



P to Q :-

Time = $1\frac{1}{2}$ hrs

Dist = 90 km

$$S = \frac{D}{T} = \frac{90}{1.5}$$

= 60 km/hr

Q to R :-

Time = $\frac{1}{2}$ hr

Dist = 0 km

$$S = \frac{D}{T} = \frac{0}{0.5}$$

= 0 km/hr

R to S :-

Time = $\frac{1}{2}$ hr

Dist = 60 km

$$S = \frac{D}{T} = \frac{60}{0.5}$$

= 120 km/hr

S to T :-

Time = $\frac{3}{4}$ hr

Dist = 150 km

$$S = \frac{D}{T} = \frac{150}{0.75}$$

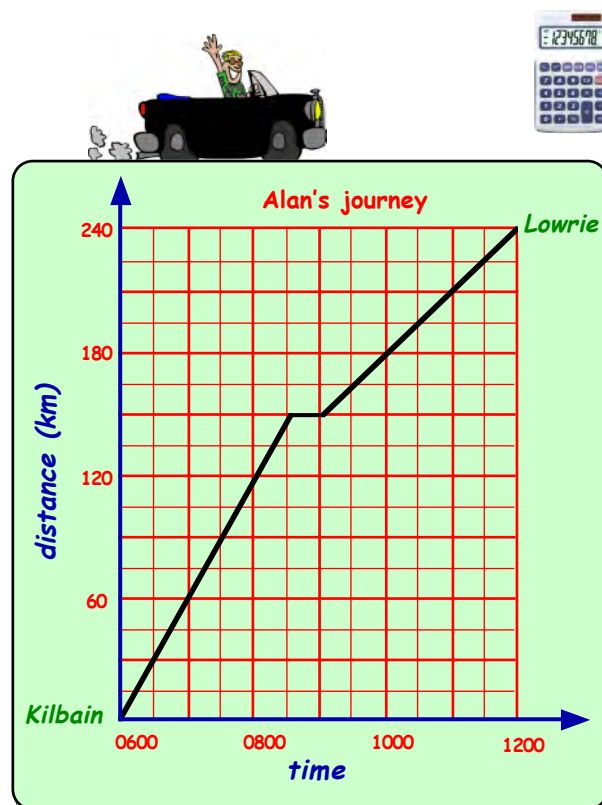
= 200 km/hr

Exercise 5

1. This time-distance graph shows Alan's journey from his home in Kilbain to a meeting in Lowrie.

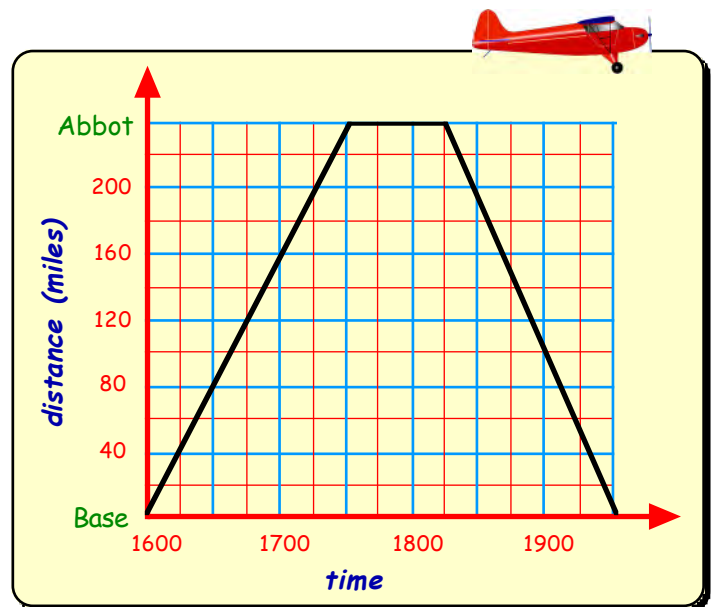
He set out at 0600 along the motorway and stopped for breakfast, before finishing the rest of his journey along the A23 trunk route.

- How long was the first part of his journey along the motorway ?
- How long did he take for his breakfast ?
- When did he arrive in Lowrie ?
- Calculate Alan's speed :-
 - on the motorway.
 - between 8.30 am and 9 am.
 - along the A23.



2. Johanna flew her light aircraft from her base to Abbot Airfield, picked up 3 passengers and flew back to base.

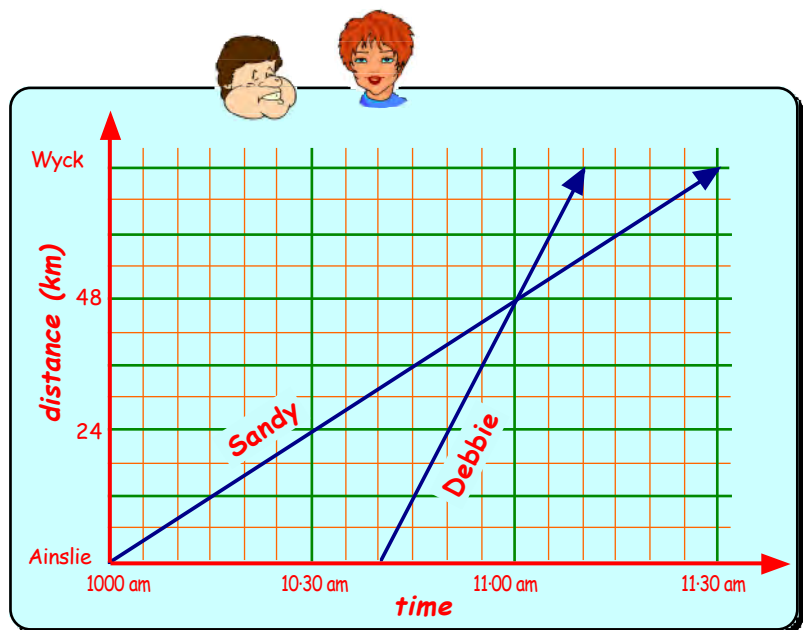
- For how long was Johanna on the ground at Abbot Airfield?
- Calculate her speed for the outward flight to Abbot.
- She had a "tail wind" on the way back. Calculate her return speed.
- From your answers to b and c, say whether the "tail wind" slowed her down or helped her go faster.



3. Sandy set off in his car from Ainslie to Wyck at 10 am along the Scottish country roads.

Debbie caught the train instead.

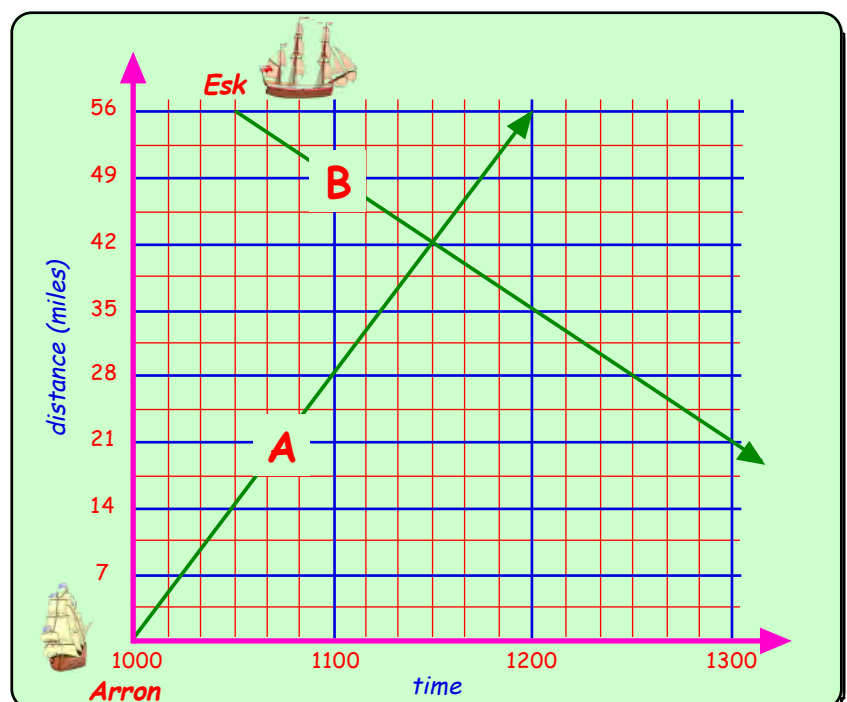
- When did her train leave?
- Calculate Sandy's speed.
- Calculate Debbie's speed.
- When did Debbie's train overtake Sandy in his car?
- How far away from Wyck were they when Debbie overtook Sandy?



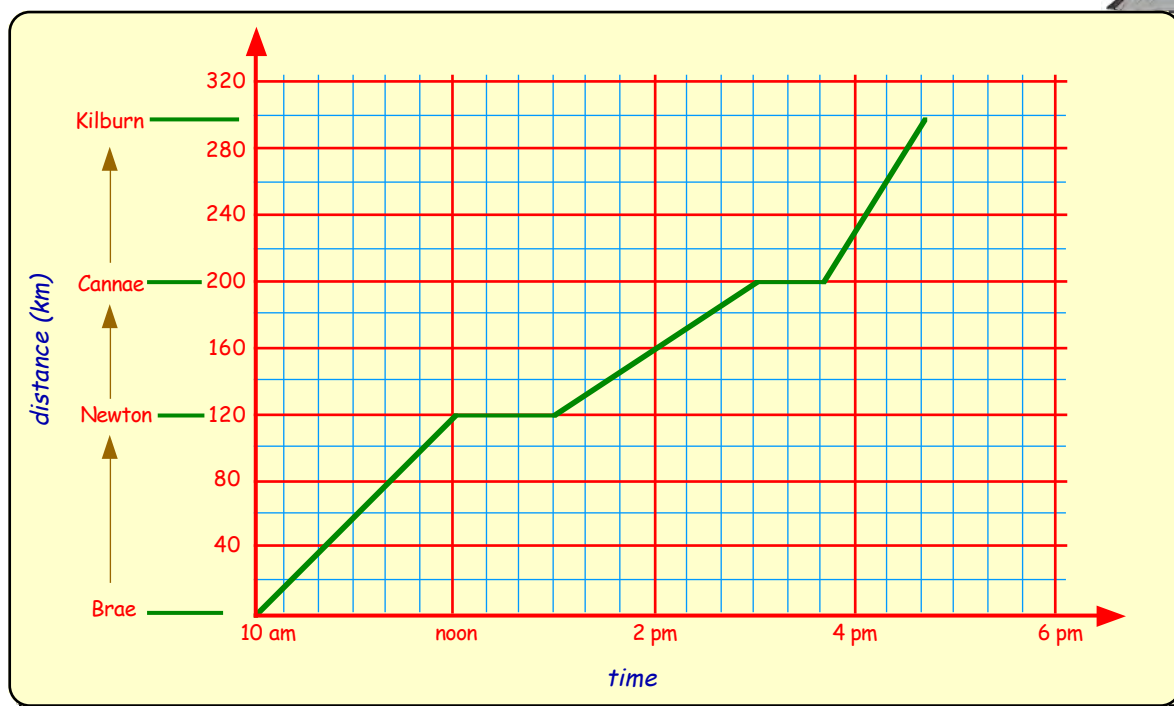
4. Two tall ships, The Lady and The Lad set sail, one from Arron and the other from Esk.

The Lad is the **slower** of the two.

- Which line, A or B, must represent the The Lad's journey? (*explain why*)
- Calculate the speed of :-
 - The Lad.
 - The Lady.
- At what time did the two ships pass each other?
- At what time should the The Lad reach Arron?



5. Terry drove a coach load of passengers on a day trip around famous landmarks.



a Make a neat copy of this timetable and complete it for Terry's trip.



Brae	Newton		Cannae		Kilburn
depart	arrive	leave	arrive	leave	arrive
10 am →	?	?	?	?	?

b How many kilometres is it from :- (i) Brae to Newton (ii) Cannae to Kilburn ?

c Calculate the average speed Terry was driving at :-

- (i) from Brae to Newton (ii) from Newton to Cannae
(iii) from Cannae to Kilburn (iv) from Brae to Kilburn.

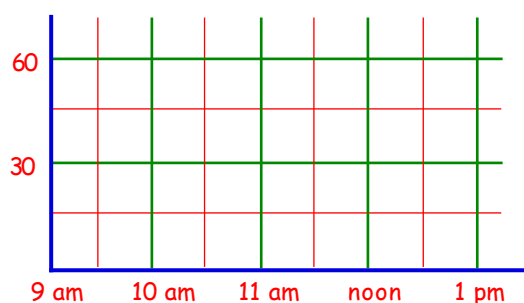
6. Dan set off driving at 9 am from Harven to Domby, 210 miles away.

He drove at an average speed of 60 miles per hour for the first 90 miles, before getting a puncture. It took him 15 minutes to change the wheel.

He then set off again and reached Domby at 1.15 pm.

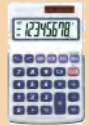


- a For how long was he driving before he got the puncture ?
b What was his average speed after he repaired the puncture ?
c Comment on Dan's speed in the 2nd part of his journey.
d Draw a graph showing all the stages of Dan's journey.



The 3 Я's

Revisit - Review - Revise



1. Calculate :-

- the **total distance** covered by a cruise ship, going at an average speed of 22 mph for 4 hours and 30 minutes.
- the **average speed** of a plane which took 7 hours 15 minutes to travel 2755 miles.
- the **time** taken by a bulldozer to travel 33 kilometres at an average speed of 12 km/hr.



2. A fire engine sped along the 52 miles from Glasgow to Edinburgh on the motorway. It managed to get to the burning office block in just 42 minutes. Had the driver broken the speed limit ? Give a reason for your answer.



3. A train left Inverness Station at 10.48 am and travelled at an average speed of 90 km/hr, arriving in Birmingham at 4.00 pm.



- How long did the train journey take ?
- How far is it by rail from Inverness to Birmingham ?

4. A marathon runner out training, set off at 20:30 and ran for 6.5 miles through the countryside at an average speed of 10 mph, until he arrived back home.

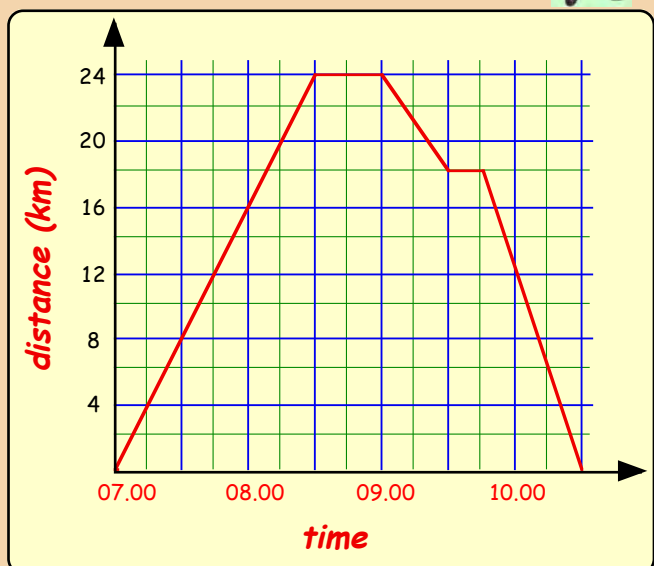
- How long did his training run last, in minutes ?
- At what time did he arrive back home ?



5. Jenny cycled the 24 km from her house to Gerry's Cafe for her breakfast. She then cycled home, taking a different route from her outward journey.



- Jenny's first stop was for breakfast. What time was that ?
- How long did she take for that ?
- Calculate her average speed for the outward journey.
- Say what Jenny did around half past nine.
- From 09.45, the final part of her journey was all downhill. How long did it take her ?
- Find her average speed for that part.

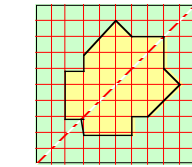
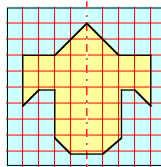


answers to Book 3a

Answers to Chapter 0 (page 1)

1. a 7000 b 50000
2. $7200 + 2000 = 9200$
3. a 8100 b 12900
4. eight hundred and seventy thousand and sixty
5. a 3540 b 27802 c 4411 d 12354
6. a 33304 b 210420 c 1869 d 13758
7. 568 ml
8. a 249 b 9.16 c 0.74
9. a 182000 b 960 c 693000 d 2080
10. 1000
11. a 27 b 13.1 c 5.10
12. a 42.54 b 53.92 c 72.24 d 17.82
13. a 198.2 b 0.347 c 240.5 d 4.05
14. a 2 b 12 c 9 d 3
15. -24°C
16. a -5 b 5 c -4 d -10
17. a 43, 47 b 52, 45 c 3, -2 d 16, 32
18. (0), 8, 16, 24, 32, 40
19. 1, 2, 4, 5, 10, 20
20. a 6 b 30
21. $7/12$
22. $3/8$
23. 60%
24. 10%
25. a $6/10$ b $10/14$
26. a $2/3$ b $2/5$
27. a 15 m b £2.00 c £1.50
28. 0.7, $3/4$, 80%
29. $24/100 = 6/25$
30. a £1.20 b 90p c £4
31. 60%
32. No - Short by 45p.
33. pack of 4 costs 31p each ($\sqrt{\text{ }}$ - better)
pack of 6 costs 33p each
34. \$480
35. £4.50 altogether
36. 10.10 pm
37. 195 seconds
38. 12 mins 30 secs
39. Bonny - by 2.70 secs
40. 1 hr 45 mins
41. 60 miles per hour
42. 50 to 80 cm
43. 19 cm^2
44. 12.8 cm - 12 cm 8 mm - 128 mm
45. 3 metres 6 cm
46. 5070 grams
47. 3500 ml
48. 3050 metres
49. a 28 cm^2 b 45 cm^2
50. 3.6 cm

51. a 5000 cm^3 b 5 litres
52. $T = 9k$
53. $W = 50T + 80$
54. a $x = 8$ b $x = 7$ c $x = 7.5$
55. $\{-3, -2, -1, 0, 1, 2\}$
56. various "-
- all 4 angles are right angles
- 2 lines of symmetry
- diagonals the same length
- fits its outline 4 ways etc.
57. 8
58. C
59. a acute b reflex
60. a $(70 \pm 2)^{\circ}$ b $(113 \pm 2)^{\circ}$
61. North West
62. $074^{\circ} (\pm 2^{\circ})$
63. B 1 cm = 50 m
64. a I(6, 5) b L(7, 1)
65. a 25% b 75
66. $3/8$
67. 0.87
68. a



Answers to CHAPTER 1 (page 7)

Chapter 1 - Exercise 1 (page 7)

1. a 4.2 b 3.5 c 6.5 d 7.3
e 9.4 f 0.5 g 10.9 h 9.0
i 10.6 j 0.9 k 20.0 l 100.0
2. a 7.58 b 9.63 c 3.99 d 5.40
e 0.25 f 13.48 g 9.05 h 4.99
i 9.95 j 0.52 k 10.00 l 100.00
3. a 8.792 b 11.505 c 0.299 d 215.403
e 2.457 f 10.081 g 34.999 h 3.000
4. a 24.5 b 1.77 c 0.816
d 8.77 e 9.79 f 0.556
g 10.15 h 0.5432 i 12
j 2.000 k 23.77 l 100.0
5. a 11.16 b 9.06 c 20.00 d 61.89
e 2.96 f 1017.90 g 1.56 h 6.00
i 24.73 j 301.50 k 6.48 l 3.17
6. a 1.672 b 2.48 c 22.861
d 0.0700 e 0.9 f 0.0713
7. a 85p b £911.11 c £142.85
d In reverse, 3 trips x 8 people is only 24.
Needs a 4th trip to take the last 2 up.
8. To make it seem cheaper - £1.499 sounds a bit less than £1.50.

Chapter 1 - Exercise 2 (page 9)

1. a 3 b 1 c 3 d 3
e 2 f 6 g 1
2. a 3 b 3 c 4 d 3
e 3 f 7 g 4 h 3
i 2 j 7 k 4 l 2
m 7 n 6 o 1 p 2
3. a 50 b 400 c 7000 d 70000
e 3000 f 3000 g 5 h 0.06
i 0.7 j 0.007 k 0.0007 l 30
4. a 310 b 7100 c 21000 d 450000
e 37 f 47 g 8.2 h 0.32
i 0.50 j 0.0056 k 0.034 l 39
5. a 4580 b 36100 c 99500 d 456000
e 9.32 f 22.8 g 0.451 h 0.765
i 0.00462 j 0.0109 k 0.0349 l 0.100
6. 6900 grams
7. 23400 ml
8. £1300
9. £245.43
10. a £211 b £27300 c £2810
11. £19000
12. 200 kg

Chapter 1 - Exercise 3 (page 11)

1. a 7000 b 80000 c 170000
d 20000 e 5000 f 60000
g 500000 h 400000 i 40
j 10 k 50 l 50
2. a 9500 b 50000
c 360000 d 1200000
e 300 f 240
3. a 2400 b 150000
c 250 d 9
e 2 f 32
4. a 10000 b 30

Answers to CHAPTER 2 (page 13)

Chapter 2 - Exercise 1 (page 13)

1. add - 55
2. subtract - 12875
3. multiply - 7650
4. divide - 115 weeks
5. divide first the multiply - 355
6. subtract - £1993
7. multiply - 1410 km
8. divide - 855 jars
9. subtract - 5590 feet
10. multiply - 10800 secs
11. divide - 148 days
12. a multiply and add - £31.48
b subtract - £5.73
13. divide - £269.75

14. multiply and add - £55.80
15. divide and compare - box of 6 - £2.75 each
box of 4 - £2.85 each - box of 6 better.
16. multiply and divide -
£1.86 + £4.20 + £0.59 = £6.65
17. Multiply and compare - Internet - £63.20
supermarket - £71.40 - save £8.20
18. Add and subtract - £6.25
19. Subtract and divide - £3.28
20. Multiply, add and subtract - £1.95
21. Multiply then divide - £36.99
22. Multiply and add - £224.20
23. Child ticket is £1.30
24. Trial and Error - 7 apples and 3 pears

Chapter 2 - Exercise 2 (page 16)

1. a add 40 then take away 1
b 90 take away 70 then add 2
c add 400 then take away 10
d 80 - 30 and 7 - 4
e add 23 and 45 then add 2 zeros at end
f 520 take away 300 then add 20
2. a 97 b 119 c 104 d 126
e 45 f 16 g 28 h 31
i 540 j 910 k 580 l 1310
m 420 n 330 o 560 p 720
q 20 r 440 s 270 t 140
u 6800 v 8700 w 4500 x 2100
3. a 93 b 310 c £601
4. a 9×80 then add 9×3 = 747
b $3 \times £6$ then take away $3 \times 1p$ = £17.97
c $5 \times £2$ then take away $5 \times 3p$ = £9.85
d $30 \div 3$ and add $12 \div 3$ = 14
e $50 \div 5$ and add $15 \div 5$ = 13
f $174 \div 2 = 87 \div 3$ = 29
5. a 52 b 138 c 405 d 728
e £5.97 f £27.93 g £11.84 h £55.80
i 18 j 63 k 34 l 12
m 21 n 27 o 19 p 14
6. a £2997 b 48

Chapter 2 - Exercise 3 (page 18)

1. a 360 b 1640 c 1600
d 3300 e 2280 f 27900
g 31200 h 72000 i 480000
j 4 k 24 l 4
m 71 n 3 o 60
2. a 5550
b 21350 c 12360 d 41520
e 10080 f 43960 g 70950
h 21
i 27 j 19 k 9
l 54 m 578 n 172
3. a 40800
b 161700 c 123000 d 158400
e 614000 f 1828000 g 12270000
h 21
i 18 j 181 k 721
l 42 m 147 o 247
4. a 2800 b 54000 c 70
d 70 e 200000 f 420000
g 30 h 500 i 2800000
j 10000000 k 200 l 9000
m 72000000 n 620 o 4450
5. a £3000000 b 56 c 2160000
d 15000 e (i) £2500000
(ii) £75000000 (iii) £30000000

Chapter 2 - Exercise 4 (page 20)

1. a 49 b 14 c 50
d 45 e 95 f 50
2. a 20 b 4 c 2

- d 4 e 14 f 6
g 30 h 15 i 1
3. a 30 b 15 c 180
d 2 e 0 f 2
4. a $(3 + 7) \times 2$
b $16 - (7 \times 2)$
c $(20 + 18) \div 2$
d $(40 + 20) \div (4 \times 5)$
e $(15 + 30) \div (12 - 3)$
f $5 + 8 \times (6 - 2) + 5$
5. a 100 b 20 c 240
d 50 e 60 f 79
g 100 h 3 i 4

Answers to CHAPTER 3 (page 23)

Chapter 3 - Exercise 1 (page 23)

1. a 60 b 20 c 50 d 55
e 65 f 15 g 48 h 59
2. a 30° b 80° c 2° d 79°
e 71° f 17° g 81.5° h 37.5°
3. 45°
4. a 133 b 63 c 129 d 144
e 58 f 90 g 36 h 60
i 60 j 45 k 30
5. a 80° b 155° c 43° d 4°
e 179° f 69° g 0.5° h 92.5°
6. 90°
7. a 7° b 97°
8. a 360 b 360
9. a 240° b 120°
10. a 150° b 108°

Chapter 3 - Exercise 2 (page 25)

1. a 110° b 160° c 90° d 140°
e 135° f 90° g 90° h 66°
i 108° j 128° k 90° l 50°
2. various

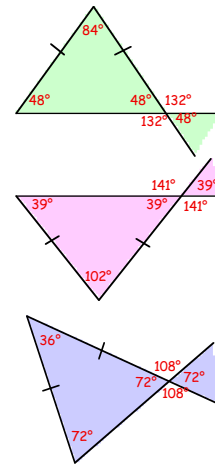
Chapter 3 - Exercise 3 (page 26)

1. a 122° b 35° c 53°
d 25.5° e 90° f 139°
g 58° h 88° i 101.5°
2. see drawings
3. various

Chapter 3 - Exercise 4 (page 27)

1. a $34^\circ, 79^\circ, 67^\circ$ (approx) b 180°
2. various
3. a 95° b 85°
4. a 50° b 42° c 46° d 139°
e 133° f 36° g 100° h 33°
5. a 40° b 75°
6. Practice spelling ISOS-CELES
7. a 38° b 104°
8. a $75^\circ, 30^\circ$ b $46^\circ, 88^\circ$
c $52^\circ, 76^\circ$ d $81^\circ, 18^\circ$
e $60^\circ, 60^\circ$ f $78^\circ, 24^\circ$
g $32^\circ, 116^\circ$ h $69^\circ, 42^\circ$
9. a 50 b 25
10. a 70° b 55° c 79° d 68°
e 73° f 46° g 36° h 20°
11. a 55° b 55° c 70°
12. a $60^\circ, 60^\circ, 60^\circ$ b $35^\circ, 35^\circ, 110^\circ$
c $100^\circ, 80^\circ, 20^\circ$ d $47^\circ, 86^\circ, 133^\circ$
e $86^\circ, 8^\circ, 94^\circ$ f $50^\circ, 50^\circ, 130^\circ$
13. $61^\circ, 61^\circ, 58^\circ$

14. a/b/c



15. a equilateral b 60°

Chapter 3 - Exercise 5 (page 30)

1. a 50° b 14° c 46° d 45°
e 130° f 90° g 60° h 156°
i 130° j 55° k 50° l 57°
m $130, 50^\circ, 50^\circ$ n $36^\circ, 144^\circ, 144^\circ$
o $9^\circ, 171^\circ, 171^\circ$ p $41^\circ, 139^\circ, 139^\circ$
q 50° r $76^\circ, 28^\circ$
s $48^\circ, 84^\circ$ t $67^\circ, 46^\circ$
u $70^\circ, 65^\circ$ v $55^\circ, 55^\circ, 70^\circ$
w $75^\circ, 30^\circ, 105^\circ$ x $41^\circ, 41^\circ, 98^\circ$

Answers to CHAPTER 4 (page 32)

Chapter 4 - Exercise 1 (page 32)

1. a -3°C b -12°C c -12°C d -70°C
2. a He had £375 in his account
b He was overdrawn by £400
c +£33 d -£5 e -£50
3. a (i) +1966 (ii) +312 (iii) -21 (iv) -729
b 55 or 56 dependant on his birthday
c 81 or 82 dependant on his birthday
d 35 A.D. (or 36 A.D.)
e 9 or 10 B.C.
4. a (i) +100 (ii) -100 (iii) 0 (iv) 150
(v) -200 (vi) 225 (vii) -25 (viii) -175
(ix) 275
b (i) 100 (ii) 25 (iii) 50 (iv) 75
(v) 50 (vi) 250 (vii) 200 (viii) 125
(ix) 300 (x) 450
5. a 14°C b 23°C c 32°C d 12°C
e 0°C f 5°C g -16°C h 7°C
i -3°C j -42°C k -20°C l -60°C
m -7°C n -5°C
6. a 4°C up b 14°C down
c 40°C down d 25°C up
e 17°C down f 7°C up
g 17°C down h 22°C down
i 41°C up j 70°C down
7. 19°C
8. a 15°C b -5°C c -25°C d -75°C
9. -75°C

Chapter 4 - Exercise 2 (page 35)

1. a 17 b 16 c 29 d 4
e 6 f 0 g -6 h -7
i -16 j 7 k 0 l 11
m -3 n -9 o -13 p -15
q -20 r -30 s -8 t -34
u -30 v -70 w -25 x -8

- | | | | | |
|----|-------|-------|--------|--------|
| 2. | a 5 | b 0 | c 18 | d -2 |
| | e -5 | f -8 | g -14 | h -8 |
| | i -10 | j -20 | k -25 | l -25 |
| | m -20 | n -38 | o -300 | p -100 |
| | q -26 | r -26 | s -14 | t -60 |
| | u -2 | v -70 | w -36 | x -8 |

Chapter 4 - Exercise 3 (page 36)

- | | | | | |
|----|----------|----------|---------|-----------------|
| 1. | a 10 | b 18 | c 9 | |
| | d 30 | e 23 | f 18 | |
| 2. | a 17 | b 23 | c 12 | d 19 |
| | e 31 | f 50 | g 26 | h 500 |
| | i 40 | j 8 | k 8 | l $\frac{1}{2}$ |
| | m 3 | n 6 | o 2 | p -2 |
| | q 2 | r -8 | s 0 | t 40 |
| | u -20 | v -10 | w -1.3 | x 0 |
| 3. | a $7x$ | b $16x$ | c $8a$ | d $20a$ |
| | e $12p$ | f $25w$ | g $25h$ | h $110m$ |
| | i $4x$ | j $-5x$ | k 0 | l $3d$ |
| | m $-11w$ | no $-9w$ | o $4n$ | p $-30q$ |

Chapter 4 - Exercise 4 (page 37)

- | | | | | |
|----|-------|--------|--------|--------|
| 1. | a -12 | b -30 | c -16 | d -64 |
| | e -54 | f -40 | g -44 | h -56 |
| | i -45 | j -28 | k -80 | l -100 |
| | m -15 | n -90 | o -100 | p -400 |
| 2. | a -3 | b -5 | c -7 | d -5 |
| | e -7 | f -6 | g -11 | h -9 |
| | i -1 | j -19 | k -9 | l -20 |
| 3. | a 4 | b -8 | c -21 | d -80 |
| | e -6 | f -12 | g -8 | h -40 |
| 4. | a 15 | b -18 | c -16 | |
| | d -7 | e -30 | f -45 | |
| | g -44 | h -2 | i -6 | |
| 5. | a -8 | b no | c -8 | |
| 6. | a -4 | b -4 | c -2 | d -5 |
| | e -9 | f -5 | g -7 | h -14 |
| | i -12 | j -20 | k -20 | l -7 |
| | m -1 | n -3.5 | o -7.5 | p -0.5 |
| 7. | a 8 | b 15 | c 54 | d 28 |
| | e 48 | f 25 | g 13 | h 80 |
| | i 81 | j 80 | k 180 | l 6000 |
| 8. | a 3 | b 7 | c 8 | d 9 |
| | e 5 | f 4 | g 6 | h 40 |
| | i 9 | j 30 | k 80 | l 49 |
| 9. | a -4 | b 8 | c 60 | d 10 |
| | e -9 | f 30 | g 28 | h 64 |
| | i 7 | j -42 | k -90 | l -200 |
| | m 1 | n 4 | o 64 | p 400 |
| | q -1 | r 16 | s -1 | t -1 |

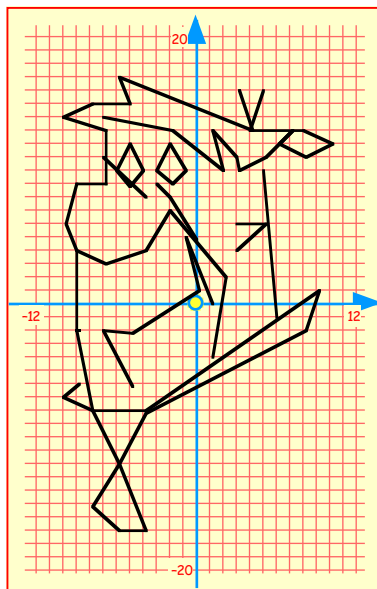
Chapter 4 - Exercise 5 (page 39)

- | | | | | |
|----|---|-------|-------|-------|
| 1. | a -3 | b -10 | c 8 | d -30 |
| | e 9 | f -15 | g 10 | h 10 |
| | i 0 | j -40 | k 1 | l -9 |
| | m -6 | n -9 | o -3 | p 0 |
| 2. | a -4 | b -9 | c 60 | |
| | d 4 | e 39 | f -60 | |
| 3. | a -10 | b -24 | c 14 | d 80 |
| | e -4 | f -5 | g 5 | h 4 |
| | i -30 | j 10 | k -6 | l 0.5 |
| 4. | a 15 | b 54 | c 1 | |
| | d 3 | e -1 | f 0 | |
| 5. | She ended up £14 overdrawn (-£14) | | | |
| 6. | a $(-30) \div 5 = -6^\circ\text{C}$ b $(-25) \div 5 = -5^\circ\text{C}$
Swedish village 1°C warmer on average. | | | |

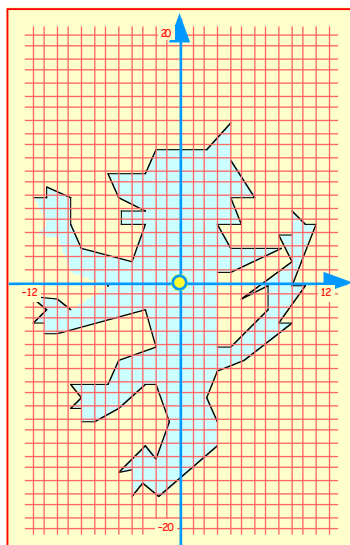
Answers to CHAPTER 5 (page 41)

Chapter 3 - Exercise 1 (page 23)

1. B(5, 3), C(3, -2), D(-4, -1), E(0, 3), F(-1, -3), G(-3, 0), H(5, -3), I(0, -2)
2. a J(4, 4), K(-3, 3), L(-4, -2), M(-1, -2), N(3, -1), O(0, 0), P(6, -3), Q(0, -3), R(0, 2), S(-2, 0), T(-2, -1)
b S c Q, R d S, T e T, N
f S & T and R & Q g T & N, L & M, Q & P
h J
3. a See diagram
4. a a kite b parallelogram
c isosceles triangle d rhombus
e pentagon f hexagon
5. a see diagram b S(-3, -3) c $(1, -\frac{1}{2})$
6. a see diagram b (-5, -1)
7. a A(1, 2), B(5, 2), C(5, 4)
b A'(1, -2), B'(5, -2), C'(5, -4)
c A''(-1, -2), B''(-5, -2), C''(-5, -4)
8. a see diagram b trapezium
c/d E'(2, -1), F'(3, -6), G'(5, -6), H'(6, -1)
9. a see diagram
b P'(0, 1), Q'(1, 6), R'(4, 7), S'(5, 2)
c P''(0, -1), Q''(-1, -6), R''(-4, -7), S''(-5, -2)
- 10/11/12. - see diagrams
- 13.



14.



Answers to CHAPTER 6 (page 46)

Chapter 6 - Exercise 1 (page 46)

- | | | | |
|----|-----------|---------------------|------------|
| 1. | a £1.50 | b £35 | c £1.510 |
| | d 320 kg | e 315 kg | f 16 kg |
| | g £4.80 | h 1.2 cm | i 7200 km |
| | j £250000 | k 12.4 ml | l 70 cm |
| | m £16 | n 1.5 mm | o 25p |
| 2. | a £2.20 | b £9 | c 960p |
| | d 240 m | e 63 ml | f 900 mm |
| | g 5500 g | h £144 | i 36000 kg |
| | j £200 | k £46 | l \$891 |
| | m 43 ml | n £7.50 | o 40 km |
| 3. | a 90% | b 324 | |
| 4. | a £24 | b £96 | c £21 |
| 5. | £22.50 | | |
| 6. | £16.40 | | |
| 7. | a 160 | b 240, 360, 120, 80 | |
| 8. | 7700 km | | |
| 9. | 444 | | |

Chapter 6 - Exercise 2 (page 48)

- | | | | |
|----|---------------------------------|---------------|------------|
| 1. | a £195 | b 374.4 km | c £14.14 |
| | d 340.2 ml | e 27 kg | f 158.4 mm |
| | g £47.40 | h 16.8 cm | i 7200 km |
| | j 1.26 cm | k 9.5 km | l £57500 |
| | m £808 | n 187.5 km | o £7.50 |
| 2. | a 336 | b 688 | c 1872 |
| | d £5.40 | e £428.40 | f 80.04 kg |
| 3. | a (i) 9.1 kg (ii) 60.9 kg | b 2 hr 42 min | |
| 4. | a (i) £18 (ii) £138 | b £16.02 | |
| 5. | a 11040 ml | b £2183 | |
| 6. | £61.60 - £59.25 - Shop B better | | |
| 7. | a £9600 | b £16800 | |
| 8. | 10% | | |

Chapter 6 - Exercise 3 (page 50)

- | | | | |
|-----|--|-------------|------------|
| 1. | a 28% | b 80% | |
| | c 60% | d 45% | |
| 2. | a 0.2, 20% | b 0.15, 15% | c 0.8, 80% |
| | d 0.28, 28% | e 0.58, 58% | f 0.1, 10% |
| 3. | a 20% | b 20% | c 60% |
| | d 20% | e 30% | f 40% |
| 4. | a 75% | b 80% | |
| 5. | a English - 75%, French - 80%, History - 78% | b French | c English |
| 6. | a 80% | b 60% | c 48% |
| | d 64% | e 85% | f 70% |
| | g 90% | h 75% | |
| 7. | a Lynda | b Jane | |
| 8. | a $2X1-60\%$, $2X2-75\%$, $2X3-64\%$, $2X4-75\%$ | | |
| | b $2X1-40\%$, $2X2-25\%$, $2X3-36\%$, $2X4-25\%$ | | |
| 9. | a 45%, 0.5, $\frac{40}{50}$ | | |
| | b $\frac{19}{25}$, 77%, 0.8 | | |
| | c $\frac{2}{13}$, $\frac{1}{6}$, 17%, 0.2 | | |
| 10. | a $33\frac{1}{3}\%$ of £540, 20% of 50% of £1560, $0.28 \times £520$ - $\frac{4}{9}$ of £297 | | |
| | b half a % of 42000 - 65% of 320 - 0.85×240 - $\frac{2}{3}$ of 300 | | |
| 11. | £345.60 | | |
| 12. | various | | |

Answers to CHAPTER 7 (page 54)

Chapter 7 - Exercise 1 (page 54)

- | | | | |
|----|----------|-----------|----------|
| 1. | a $2p$ | b $3k$ | c $5w$ |
| | d x | e $2y$ | f h |
| | g $3p$ | h $3k$ | i 0 |
| | j $3x+y$ | k $2a$ | l $g+2h$ |
| | m m | n $10x-1$ | o $2a+5$ |

- $p \ p \quad q \ 6+u \quad r \ 9p+q$
 $s \ -g+4h \quad t \ 0 \quad u \ x+4$
 $v \ 10l+1 \quad w \ 9+w \quad x \ 2a+b$
 $y \ 3x^2 \quad z \ 2q^2$
2. $a \ 8p \quad b \ 4w \quad c \ m^2 \quad d \ d^8$
 $e \ 12e \quad f \ 0.5h \quad g \ 1.2n \quad h \ 5y^2$
 $i \ 48u \quad j \ 56p \quad k \ 12c^2 \quad l \ 3pq$
 $m \ w^3 \quad n \ u^3 \quad o \ 9ab \quad p \ 15pq$
 $q \ 3y^{23} \quad r \ 10g^3 \quad s \ 20h^3 \quad t \ 4q^2$
 $u \ 4 \quad v \ 10 \quad w \ 2b \quad x \ 2x$
 $y \ 3x \quad z \ 3x$
3. $a \ 7x^2 \quad b \ 5a^2 \quad c \ 7K^2 \quad d \ 8y$
 $e \ 21n^2 \quad f \ 32mn \quad g \ 30d \quad h \ 63e^2$
 $i \ 100xy \quad j \ 5a \quad k \ 12a^2b \quad l \ 7$
 $m \ 20f \quad n \ 14x-4yo \quad z+1 \quad p \ 2a^3+2$
 $q \ 7x^2 \quad r \ 8m-n \quad s \ u+10 \quad t \ 5x$
 $u \ 8-2a \quad v \ 8g-2 \quad w \ 1 \quad x \ 8x^2-6$
 $y \ 8p^2-8 \quad z \ 7k$
4. $a \ x^2+10x+24 \quad b \ y^2+12y+20$
 $c \ 4mn \quad d \ 9a+3ab$
 $e \ 80pq \quad f \ k^2+12k+32$

Chapter 7 - Exercise 2 (page 56)

1. $a \ 2a+10 \quad b \ 3x+6 \quad c \ 6g+6$
 $d \ 7m+28 \quad e \ 2x-6 \quad f \ 5n-10$
 $g \ 8p-8 \quad h \ 10t-40 \quad i \ 5m-20$
 $j \ 2-2u \quad k \ 14-7x \quad l \ 30+15k$
 $m \ 4a+4b \quad n \ 2c+2d \quad o \ 5m-5n$
 $p \ 10d-10e \quad q \ 60+20x \quad r \ 120-30w$
 $s \ 100a-300 \quad t \ 50g-300$
2. $a \ 6x+2 \quad b \ 8a+6 \quad c \ 3+15d$
 $d \ 12-20k \quad e \ 49h-14 \quad f \ 40-32n$
 $g \ 30a+6y \quad h \ 12t+4z \quad i \ 10b-8c$
 $j \ 70k-14b \quad k \ xy+2x \quad l \ ab-8a$
 $m \ vw-v \quad n \ a^2-3a \quad o \ p-p^2$
 $p \ 2x+x^2 \quad q \ 3pq+pr \quad r \ 10a-20a^2$
 $s \ 20u^2-2uy \quad t \ 6a+4b+2 \quad u \ 10w+30w+40y$
 $v \ 15x-6y-12z \quad w \ 10p+10q-40r \quad x \ 24u-40v-72$
3. $a \ -3x-3 \quad b \ -2a+10 \quad c \ -m-n$
 $d \ -m+n \quad e \ -6p+6q \quad f \ -x^2-7x$
 $g \ -p-p^2 \quad h \ -2w^2-18w \quad i \ -7k^2+k$
 $j \ -8e^2-40e \quad k \ -3xy+8x^2 \quad l \ -p^3+10p^2q$
4. $a \ 3(x+6)=3x+18$
 $b \ 7(10-a)=70-7a$

Chapter 7 - Exercise 3 (page 57)

1. $a \ 2x+6 \quad b \ 3a+17 \quad c \ 5p+7$
 $d \ 6w \quad e \ 10k+2 \quad f \ d+6$
 $g \ 20+2g \quad h \ 10x+20 \quad i \ 12a-8$
 $j \ 22q-10 \quad k \ 5w-1 \quad l \ 9a+24b$
 $m \ 15m+16q \quad n \ 20x-40y \quad o \ 100p+6q$
 $p \ 3x+4 \quad q \ -10b \quad r \ 100w+20z$
 $s \ 2g \quad t \ 7m+14n+1 \quad u \ 2e-4f$
2. $a \ 5x+8 \quad b \ 9a+21 \quad c \ 7h+3$
 $d \ 9m+3 \quad e \ 17+v \quad f \ 9+u$
 $g \ 20e+4 \quad h \ 12+2x \quad i \ 8b+20a$
3. $a \ x+5 \quad b \ a+2 \quad c \ 4p+2$
 $d \ 4p+4 \quad e \ 2k+18 \quad f \ 1+8m$
 $g \ 8+2d \quad h \ h^2+h+3 \quad i \ 3a^2-5a+12$
4. $a \ -2x-2 \quad b \ 3w+1 \quad c \ 10-5d$
 $d \ 20-5h \quad e \ 5+6m \quad f \ -2g$
 $g \ 2a-20 \quad h \ 6t \quad i \ 7x-4$
5. $x^2+4x-(5x-10)=x^2-x+10$

Chapter 7 - Exercise 4 (page 58)

1. $a \ 2 \quad b \ 5 \quad c \ 7$
 $d \ 20 \quad e \ 70 \quad f \ -1$
 $g \ 6 \quad h \ -9 \quad i \ 3$
 $j \ -8 \quad k \ 0 \quad l \ -50$

- $m \ 7 \quad n \ 7 \quad o \ 1/4$
 $p \ 6^{2/3} \quad q \ 1/6 \quad r \ 2^{1/2}$
2. $a \ 10 \quad b \ 7 \quad c \ 27$
 $d \ 6 \quad e \ 100 \quad f \ 4$
 $g \ 2 \quad h \ 3 \quad i \ 8$
 $j \ 6 \quad k \ 10 \quad l \ 8$
 $m \ 28 \quad n \ -1 \quad o \ 4^{1/2}$
 $p \ -4 \quad q \ 2^{1/2} \quad r \ 4^{3/4}$

Chapter 7 - Exercise 5 (page 59)

1. $a \ 3 \quad b \ 2 \quad c \ 1$
 $d \ 6 \quad e \ 3 \quad f \ 4$
 $g \ 4 \quad h \ 5 \quad i \ 5^{1/2}$
 $j \ 3 \quad k \ 5 \quad l \ -1$
 $m \ 2 \quad n \ 4 \quad o \ 1$
 $p \ 6 \quad q \ 4^{1/2} \quad r \ 5$
 $s \ 2 \quad t \ 5 \quad u \ 1$
 $v \ 9 \quad w \ 2 \quad x \ 8$
2. $a \ 12 \quad b \ 9 \quad c \ 16$
 $d \ 4 \quad e \ 5 \quad f \ 8$
 $g \ 12 \quad h \ 5 \quad i \ 100$
 $j \ 4 \quad k \ -4 \quad l \ -3$
 $m \ 1/3 \quad n \ 11 \quad o \ 7^{1/3}$
 $p \ 2 \quad q \ -2 \quad r \ 1/2$
 $s \ 9 \quad t \ -1^{1/2} \quad u \ 3^{1/2}$
 $v \ 20 \quad w \ 2 \quad x \ 4$
 $y \ 1 \quad z \ 4$

Chapter 7 - Exercise 6 (page 60)

1. $a \ 9 \quad b \ 2 \quad c \ 24 \quad d \ -4$
 $e \ 14 \quad f \ -7 \quad g \ 9 \quad h \ 27$
 $i \ 0 \quad j \ 18 \quad k \ 12 \quad l \ 5.4$
2. $a \ 20 \quad b \ 28 \quad c \ 16 \quad d \ 32$
 $e \ 64 \quad f \ 160 \quad g \ 1280 \quad h \ 2$
3. $a \ 16 \quad b \ 1 \quad c \ 16 \quad d \ 6$
 $e \ 20 \quad f \ -5 \quad g \ -40 \quad h \ 36$
4. $a \ 11 \quad b \ 24 \quad c \ -10$
 $d \ 21 \quad e \ 90 \quad f \ 31$
 $g \ 2 \quad h \ 2 \quad i \ 5$
5. $a \ 9 \quad b \ 25 \quad c \ 1 \quad d \ 2$
 $e \ 49 \quad f \ 18 \quad g \ 6 \quad h \ 1$
 $i \ 3 \quad j \ 4 \quad k \ 5 \quad l \ 49$
6. $a \ 18 \quad b \ 1 \quad c \ 4$
 $d \ 18 \quad e \ 44 \quad f \ 5$
 $g \ 59 \quad h \ 3 \quad i \ 6$
7. $a \ 1 \quad b \ 2 \quad c \ 4$
 $d \ 2 \quad e \ 2 \quad f \ 2$
 $g \ 3 \quad h \ 3 \quad i \ 300$
8. $a \ 7 \quad b \ 90 \quad c \ 150$
 $d \ 100 \quad e \ 52 \quad f \ 250$
 $g \ 22 \quad h \ 60 \quad i \ 30$
 $j \ 8 \quad k \ 10$

Chapter 7 - Exercise 7 (page 62)

1. $a \ W=x+y \quad b \ 5 \quad c \ 2.5$
2. $a \ L=m-n \quad b \ 2.25 \quad c \ 12.75$
3. $a \ S=D/T \quad b \ 60 \text{ mph} \quad c \ 330 \text{ miles}$
4. $a \ C=10+5k \quad b \ £40$
5. $a \ F=1.8C+32 \quad b \ 86^\circ\text{F}$
6. $a \ T=10g+h \quad b \ 215 \text{ mins}$
7. $a \ P=2a+2b+c \quad b \ 26 \quad c \ 16$
8. $a \ L=x+y \quad b \ P=6x+2y \quad c \ 38$
9. $a \ P=4n+2m \quad b \ 32 \quad c \ 5$
10. $a \ S=4x+40 \quad b \ 120$
11. (i) $a \ A=3(x+6)=3x+18 \quad c \ 33$
(ii) $a \ A=4(x+10)=4x+40 \quad c \ 60$
(iii) $a \ A=7(20-x)=140-7x \quad c \ 105$
(iv) $a \ A=2(9-x)=18-2x \quad c \ 8$

12. (i) $a \ A=6p \quad b \ A=4(p-3)$
 $c \ A=6p-4(p-3)=2p+12 \quad d \ 20$
- (ii) $a \ A=q(q+4) \quad b \ A=8(q-2)$
 $c \ A=q(q+4)-8(q-2)=q^2-4q+16$
 $d \ 28$

Answers to CHAPTER 8 (page 67)

Chapter 8 - Exercise 1 (page 67)

1. $a \text{ Perimeter} = 28 \text{ cm}, \text{ Area} = 40 \text{ cm}^2$
 $b \text{ Perimeter} = 27 \text{ cm}, \text{ Area} = 44 \text{ cm}^2$
 $c \text{ Perimeter} = 36 \text{ cm}, \text{ Area} = 81 \text{ cm}^2$
 $d \text{ Perimeter} = 40 \text{ cm}, \text{ Area} = 60 \text{ cm}^2$
 $e \text{ Perimeter} = 15 \text{ cm}, \text{ Area} = 9 \text{ cm}^2$
 $f \text{ Perimeter} = 54 \text{ cm}, \text{ Area} = 170 \text{ cm}^2$
 $g \text{ Perimeter} = 36 \text{ cm}, \text{ Area} = 54 \text{ cm}^2$
 $h \text{ Perimeter} = 28 \text{ cm}, \text{ Area} = 21 \text{ cm}^2$
 $i \text{ Perimeter} = 2 \text{ cm}, \text{ Area} = 0.25 \text{ cm}^2$
2. $a \ 81 \text{ cm}^2 \quad b \ 24000 \text{ mm}^2 \quad c \ 5 \text{ m}^2$
 $d \ 540 \text{ m}^2 \quad e \ 72.5 \text{ cm}^2 \quad f \ 2.4 \text{ m}^2$
3. $a \ 170 \text{ m}^2 \quad b \ 10 \quad c \ £130$
4. $a \ 14.8 \text{ m} \quad b \ £35$
5. $£600$

Chapter 8 - Exercise 2 (page 69)

1. $a/b \text{ see drawing}$
 $c \ 48 \text{ cm}^2 \quad d \ 24 \text{ cm}^2$
2. (i) $a \ 120 \text{ cm}^2 \quad b \ 60 \text{ cm}^2$
(ii) $a \ 60 \text{ cm}^2 \quad b \ 30 \text{ cm}^2$
(iii) $a \ 130 \text{ cm}^2 \quad b \ 65 \text{ cm}^2$
3. $a \ 30 \text{ cm}^2 \quad b \ 48 \text{ cm}^2 \quad c \ 35 \text{ cm}^2$
 $d \ 1100 \text{ mm}^2 \quad e \ 6.2 \text{ m}^2 \quad f \ 9.62 \text{ cm}^2$
4. $a \ 18 \text{ cm}^2 \quad b \ 31.5 \text{ cm}^2 \quad c \ 9.5 \text{ cm}^2$
 $d \ 26 \text{ cm}^2 \quad e \ 875 \text{ cm}^2 \quad f \ 4800 \text{ mm}^2$
5. 6.4 m^2
6. $180 \text{ cm}^2 \times 2 = 360 \text{ cm}^2$ (fish has 2 sides)
7. 112.5 cm^2
8. 1.26 cm^2
9. $a \ 2.3 \text{ cm} \quad b \ 5.175 \text{ cm}^2$
10. 140 cm^2
11. $a \ 150 \text{ cm}^2 \quad b \ 176 \text{ m}^2 \quad c \ 4800 \text{ mm}^2$
12. 10 cm

Chapter 8 - Exercise 3 (page 72)

1. 160 cm^2
2. $a \ 99 \text{ cm}^2 \quad b \ 65 \text{ cm}^2 \quad c \ 72 \text{ cm}^2$
 $d \ 54 \text{ cm}^2 \quad e \ 22 \text{ cm}^2 \quad f \ 50 \text{ cm}^2$
 $g \ 138 \text{ cm}^2 \quad h \ 31.5 \text{ cm}^2 \quad i \ 14.4 \text{ cm}^2$
3. 5580 mm^2
4. 104 m^2
5. 14.4 m^2
6. 1200 cm^2
7. 240 cm^2
8. 14.88 m^2
9. $a \text{ RSUP and PQST} \quad b \ 810 \text{ cm}^2 - 414 \text{ cm}^2$
10. 15 cm

Chapter 8 - Exercise 4 (page 74)

1. $a \ 56 \text{ cm}^2 \quad b \ 40.5 \text{ cm}^2 \quad c \ 108 \text{ cm}^2$
 $d \ 44 \text{ cm}^2 \quad e \ 2200 \text{ mm}^2 \quad f \ 3672 \text{ mm}^2$
2. 11 cm^2
3. 15360 cm^2
4. 1704 cm^2

Chapter 8 - Exercise 5 (page 75)

- a 324 cm² b 168 cm² c 240 cm²
d 1840 m² e 9792 mm² f 1400 cm²
- 152 m²
- a 95 cm² b 99 cm² c 11.84 cm²
d 102 cm² e 151 cm² f 22.75 m²
- 243 cm²
- 10.9 m²
- a 239 m² b 6270 m²

Answers to CHAPTER 9 (page 78)

Chapter 9 - Exercise 1 (page 78)

- a $\frac{6}{8} \times \frac{9}{12}$ b $\frac{2}{4} \times \frac{3}{6}$
c $\frac{2}{6} \times \frac{3}{9}$ d $\frac{4}{6} \times \frac{6}{9}$
e $\frac{4}{10} \times \frac{6}{15}$ f $\frac{10}{12} \times \frac{15}{18}$
g $\frac{6}{20} \times \frac{9}{30}$ h $\frac{2}{200} \times \frac{3}{300}$
i $\frac{14}{18} \times \frac{21}{27}$ j $\frac{22}{40} \times \frac{33}{60}$
k $\frac{14}{30} \times \frac{21}{45}$ l $\frac{18}{50} \times \frac{27}{75}$
m $\frac{38}{42} \times \frac{57}{63}$ n $\frac{2}{74} \times \frac{3}{111}$
o $\frac{222}{314} \times \frac{333}{471}$ p $\frac{14}{10} \times \frac{21}{15}$
- a $\frac{3}{4}$ b $\frac{8}{9}$ c $\frac{4}{5}$ d $\frac{1}{2}$
e $\frac{3}{4}$ f $\frac{1}{2}$ g $\frac{3}{4}$ h $\frac{13}{17}$
i $\frac{9}{10}$ j $\frac{5}{6}$ k $\frac{13}{131}$ l $\frac{4}{5}$
m $\frac{1}{20}$ n $\frac{1}{15}$ o $\frac{12}{101}$ p $\frac{1}{3}$

Chapter 9 - Exercise 2 (page 79)

- a $8\frac{1}{2}$ b $6\frac{2}{3}$ c $3\frac{5}{6}$ d $3\frac{2}{5}$
- a $4\frac{1}{3}$ b $6\frac{3}{4}$ c $7\frac{3}{5}$ d $5\frac{5}{6}$
e $8\frac{1}{9}$ f $8\frac{1}{8}$ g $8\frac{7}{10}$ h $3\frac{1}{2}$
- a $7\frac{5}{6}$ kg b $2\frac{3}{5}$ bars
c $6\frac{1}{4}$ litres d $55555\frac{5}{9}$ litres
e $1207\frac{1}{7}$ litres f $17\frac{1}{8}$ m, $11\frac{1}{4}$ m
- $\frac{20}{6} = 20 \div 6 = 3\frac{2}{6} = 3\frac{1}{3}$
- a $4\frac{1}{2}$ b $5\frac{1}{2}$ c $3\frac{1}{2}$ d $3\frac{2}{5}$
e $4\frac{1}{2}$ f $8\frac{1}{2}$ g $2\frac{1}{2}$ h $11\frac{1}{2}$
i $3\frac{1}{3}$ j $2\frac{1}{2}$ k $3\frac{1}{4}$ l $1\frac{3}{4}$
- a 4 b 8 c 3 d 11
e $2\frac{3}{4} = \frac{11}{4}$
- a 12 b 2 c 14 d $\frac{14}{3}$
- a $\frac{19}{5}$ b $\frac{13}{10}$ c $\frac{21}{8}$ d $\frac{91}{9}$
- a $\frac{21}{5}$ b $\frac{8}{3}$ c $\frac{42}{5}$ d $\frac{27}{10}$
- a $\frac{3}{2}$ b $\frac{41}{5}$ c $\frac{20}{3}$ d $\frac{37}{5}$
e $\frac{73}{7}$ f $\frac{35}{9}$ g $\frac{29}{10}$ h $\frac{139}{20}$
- a 4 b 10 c 7 d 21
- a 15 b 6 c 12 d 34
- a 8 b 5 c 19 d 14
- a $7\frac{2}{5}$ b $5\frac{1}{7}$

Chapter 9 - Exercise 3 (page 82)

- a $\frac{4}{5}$ b $\frac{2}{9}$ c $\frac{2}{5}$ d $\frac{3}{4}$
- a $\frac{4}{7}$ b $\frac{8}{9}$ c $\frac{2}{3}$ d $1\frac{1}{2}$
e $\frac{1}{6}$ f $1\frac{5}{6}$ g 1 h $\frac{1}{2}$
- a $5\frac{2}{3}$ b $4\frac{1}{5}$ c $7\frac{2}{7}$ d 4
e $\frac{3}{5}$ f $7\frac{2}{3}$ g $4\frac{4}{9}$ h $13\frac{6}{11}$
- $\frac{3}{5}$ km
- $7\frac{1}{2}$
- $48\frac{2}{5}$ kg

- a $3\frac{1}{5}$ metres b $4\frac{1}{2}$ litres
c $3\frac{2}{3}$ km d $1\frac{4}{5}$ pizzas
e $68\frac{1}{3}$ kg
- a $2\frac{2}{5}$ feet b 22 feet
- a $4\frac{1}{2}$ b $5\frac{1}{8}$ c $5\frac{3}{4}$ (all tonnes)
- $7\frac{1}{4}$ cm

Chapter 9 - Exercise 4 (page 84)

- a $1\frac{1}{12}$ b $\frac{2}{15}$ c $\frac{1}{8}$ d $1\frac{11}{21}$
- a $\frac{13}{15}$ b $\frac{1}{4}$ c $\frac{17}{24}$ d $\frac{13}{10}$
e $\frac{1}{2}$ f $\frac{1}{12}$ g $\frac{11}{10}$ h $\frac{5}{18}$
- a $1\frac{1}{12}$ b 0 c $\frac{23}{30}$
- a $10\frac{5}{6}$ b $2\frac{5}{12}$ c $2\frac{5}{8}$ d $11\frac{1}{10}$
e $1\frac{1}{6}$ f $21\frac{7}{24}$ g $29\frac{9}{20}$ h $1\frac{2}{5}$
i $17\frac{1}{9}$ j $25\frac{11}{20}$ k $3\frac{1}{2}$ l $\frac{1}{12}$
m $1\frac{19}{30}$ n $2\frac{3}{26}$ o $1\frac{17}{28}$ p $1\frac{1}{6}$
- a $2\frac{2}{3}$ b $1\frac{3}{5}$ c $2\frac{3}{8}$ d $\frac{2}{5}$
- a $2\frac{4}{5}$ b $2\frac{3}{7}$ c $4\frac{1}{6}$ d $1\frac{2}{5}$
e $\frac{3}{10}$ f $5\frac{5}{8}$ g $5\frac{2}{7}$ h $4\frac{2}{3}$
- $2\frac{5}{8}$ metres
- $47\frac{7}{8}$ miles
- a $3\frac{9}{10}$ b $1\frac{31}{40}$ c $5\frac{9}{20}$
- a $2\frac{7}{10}$ b $4\frac{23}{30}$ c $1\frac{3}{4}$ d $1\frac{5}{8}$
e $2\frac{5}{6}$ f $4\frac{9}{14}$ g $4\frac{19}{30}$ h $2\frac{23}{30}$
- a $1\frac{1}{4}$ b $\frac{1}{8}$ c $1\frac{7}{8}$
- $2\frac{3}{4}$ hours

Answers to CHAPTER 10 (page 88)

Chapter 10 - Exercise 1 (page 88)

- Practical
- a 18 cm b 60 cm c 55.5 cm
d 13.5 cm e 2.7 cm

Chapter 10 - Exercise 2 (page 89)

- 28.26 cm
- a 15.7 cm b 37.68 cm
c 1.256 cm d 32.028 cm
- 27.632 cm
- 100.48 cm
- 169.56 cm
- 37.68 inches
- 20 cm
- (i) a 14 cm b 43.96 cm
(ii) a 8 cm b 25.12 cm
(iii) a 3 cm b 9.42 cm
- a 6.5 cm b 20.41 cm
- a 6.4 cm b 20.096 cm
- a 376.8 m b 15.072 km

Chapter 10 - Exercise 3 (page 91)

- 62.8 cm
- 15.7 cm
- 4.112 m
- 12.56 metres
- 285.6 mm
- a 17.28 m b 365.6 m
c 76.84 cm d 499.8 mm
- a 25.7 m b 36.54 m
- 822.4 cm or 8.224 m
- A = 40 cm, B = 36 cm, C = 43.96 cm - B

Chapter 10 - Exercise 4 (page 93)

- 70 cm
- a 8 cm b 17 cm c 100 cm
d 3195 mm e 2 mm f 6 m
- a 5 cm b 56 mm c 85 m
- a 2.5 cm b 28 mm c 42.5 m
- a 200 cm b 125 mm
- a 28.7 cm b 0.955 cm c 15.9 cm
d 5.10 cm e 0.16 mm
- 47.8 cm
- a 80 mm b 75.4 mm

Answers to CHAPTER 11 (page 96)

Chapter 11 - Exercise 1 (page 96)

- a 2:3 b 3:2
- a 3:1 b 1:3
- a 9:19 b 19:9
- a 29:23 b 23:29
- a 2:15 b 15:2 c 2:17 d 17:15
- a 9:8 b 5:2 c 2:9
d 8:5 e 1:5 f 5:20
- a 43:27 b 27:43 c 43:140
- a 20:3 b 3:23
- a 13:60 b 13:47 c 47:13
- a 50:61 b 50:11

Chapter 11 - Exercise 2 (page 98)

- 5:3
- 6:7
- a 2:3 b 5:6 c 1:2 d 3:8
e 1:1 f 6:1 g 2:1 h 3:2
i 2:1 j 5:7 k 2:3 l 5:8
m 9:4 n 7:5 o 27:2 p 1:9
q 1:100 r 50:1 s 1:3 t 9:4
u 1:100 v 1:4000000
- a 2:1 b 4:3 c 7:2 d 4:3
- a 200:4 b 50:1
- a 15:5 b 3:1
- a 4:1 b 1:4
- a 20:16 b 5:4
- a 80000:16000 b 5:1
- a 44:55 b 4:5
- a 48:176 b 3:11
- a 72:60 b 6:5
- a 5:1 b 7:3 c 20
- a 1:10 b 1:1000 c 1:3
d 1:20 e 1:12 f 1:8
g 1:4 h 7:366 i 1:24
- a 6:30:8:10 b 7:9

Chapter 11 - Exercise 3 (page 100)

- 21
- 32 litres
- a (i) 18 (ii) 48 b (i) 8 (ii) 54
- a 4 b 10 c 16 d 30
- 160
- 170
- a 14 b 10
- a 52 b (i) 7 (ii) 35
- a £50 b £100 c £3500
- a 56 b 105
- a 21 b 56
- 378
- a OMG b Med c Mild
d Light e Very Strong
- 5.4 m b 70 cm
- Alf - £12, Jessie - £6
- Mr Green - £105, Mr Brown - £70
- a 8 b 25 c 14
d 12 e 24

Answers to CHAPTER 12 (page 104)**Chapter 12 - Exercise 1 (page 104)**

- 120 cm³
- 343 cm³
- 750 cm³
- a 210 cm³ b 504 cm³ c 440 cm³
d 105 mm³ e 300 m³ f 192 cm³
- a 2700 cm³ b 8640 cm³ c 14400 cm³
d 1000 cm³ e 243 cm³ f 25000 cm³
- a 24 m³ b 98 cm³ c 2.16 cm³
d 2156 cm³ e 42875 mm³ f 27 m³
- a 675 cm³ b 3192 cm³ c 389 cm³
d 3106 cm³ e 19440 mm³ f 7020 cm³
- 4 cm
- a H = 10 cm b B = 5 cm c L = 8 cm

Chapter 12 - Exercise 2 (page 107)

- 210 cm³
- 300 mm³
- 468 cm³
- 1080 cm³
- 450 cm³
- 4 m³
- a 30.1 cm³ b 180.6 cm³
- 3.06 m³
- a 60 cm² b 8.5 cm
- a 560 cm³ b 2160 cm³
c 1860 cm³ d 52500 cm³
- 725000 cm³
- 625 m³
- 156000 cm³

Chapter 12 - Exercise 3 (page 110)

- a 576 cm³ b 576 ml
- a 650 ml b 784 ml c 1056 ml
- a 2000 ml b 5000 ml c 8000 ml
d 25000 ml e 3200 ml f 12750 ml
g 900 ml h 11234 ml i 500 ml
j 4500 ml k 1250 ml l 3750 ml
- a 6 l b 9 l c 15 l
d 35 l e 2.5 l f 7.25 l
g 0.25 l h 1.3 l i 4.65 l
j 12.62 l k 0.1 l l 0.015 l
- a 160000 cm³ b (i) 160000 ml (ii) 160 l
- a 30 l b 60
- a 240 cm and 150 cm
b 2880000 cm³ c 1440 litres
- 2 hr 36 mins
- 144000 litres

Answers to CHAPTER 13 (page 113)**Chapter 13 - Exercise 1 (page 113)**

- £350
- a £342.90 b £312.42 c £30.48
- £103.60
- a Anne - £484.50, Peter - ££657.20
b £172.70
- £1732.50
- a £9.78 b 25 hrs c 45 hrs
- a £8.76 b £324.12
- a 150 hrs b £10.20
- Ian - £10.50 per hr, Simon - £10.60 per hr
Simon has a slightly better hourly rate
- Dick = 12 x £1246 = £14952

- Cindy = 52 x £276.25 = £14365
Dick earns £587 more than Cindy.
- £2054
 - a £378 b £19656
 - a Jack - £25800, Jill - £23402.60
b Jack earns ££2397.40 more
 - Les - £23091, Den - £20295.60
a Caro earns most
b Den earns least
 - a £300 b £287
c Hugh - £7.50/hr, Joey - £8.20/hr
Joey gets 70p more per hour
 - Job 1 = £7.95 per hour
Job 2 = £8.25 per hour - better rate
 - a £112.50 b £4.50 - (below minimum)
 - Discussion

Chapter 13 - Exercise 2 (page 116)

- £1470
- a £1071 b £23471
- a £0 b £49 c £499.80
- a £1000 b £1100
- a £2 b £18.40 c £45.20
- a £375 b £825.20
- a £8.40 b £27.60 c £28
d £26 e £67.50 f £11
g £17 h £160
- a 45p b £3.75 c £48
d £15 e £96 f £87.50
g £153.60 h £8.60
- a £16848 b £10710 c £31.25
- a ££6.75 b £20706.40

Chapter 13 - Exercise 3 (page 118)

- a £255 b £672
- £109.20
- £54
- £110
- a £525 b £1725
- £1875 7. £466
- a £1200 b £1224 c £1395
- Tracy - £1400, Edina - £1440 = better
- Alice - £2800, Ben - £3000, Carron - £3300
a Carron - most b Alice - least
- £25000
- Various

Chapter 13 - Exercise 4 (page 120)

- a £64 b £84.60 c £1204.50
d £158.40 e £84 f £153.60
g £756
- a £330.75 b £151.20 c £481.95
- £384
- £712.50
- £261.36
- a £324 b £64.80
c £43.20 d £432
- Basic = £532
Overtime = £147 + £126 = £273
Total pay = £805

Chapter 13 - Exercise 5 (page 122)

- a £13130 b £17590 c £18086.40
- a £16120 b £310
- a £4364.80 b £10835.20
- £449.80
- £2504
- a £1566 b £2684 c £1197
- a £648 b £167.40 c £480.60
- Gross - £528.50, Ded - £138.20,
Net - £390.30

- Gross - £606.90, Ded - £181.96
Net pay = £424.94
- £17575
- £382
- £10000

Answers to CHAPTER 14 (page 125)**Chapter 14 - Exercise 1 (page 125)**

- 50.24 cm²
- a 113.04 cm² b 254.34 cm² c 63.585 cm²
- a 633 mm² b 491 cm² c 0.785 m²
- a 113 cm² b 19.6 m² c 1260 mm²
- a 91.6 cm² b 13.8 cm²
c 3420 mm² d 0.196 m²
- a 8.04 m² b 1.13 m²
c 20.5 m² d 6.68 m²
- a 30 cm b 60 cm

Chapter 14 - Exercise 2 (page 128)

- a 56.5 cm² b 226 mm² c 127 m²
- a 30.8 cm b 61.7 mm c 46.3 m
- a 78.5 cm² b 154 cm² c 0.785 m²
- a 35.7 cm b 50.0 cm c 3.57 m
- a (i) 124 cm² (ii) 48.0 cm
b (i) 235 cm² (ii) 104 cm
c (i) 145 cm² (ii) 50.1 cm
d (i) 89.6 cm² (ii) 45.9 cm
- 11500 cm²
- 31.0 cm²
- a 942 cm² b 18.8 m²
- D = 30 cm, Vol = 8480 cm³
- 56.5 m
- The side of the square is 80 cm
The diameter of the circle is 81.4 cm
The square is not big enough
- a 78.5 cm² b 15.7 cm²
- a 31.4 cm b 6.28 cm
- a 1/8 b 200.96 cm² c 25.12 cm²
d 50.24 cm e 6.28 cm f 22.28 cm
- a 1/3 b 1670 cm² c 83.7 cm
- A = 339 cm², Per = 80.5 cm
- 20.9 cm
- a 141.3 cm² b 51.7 cm

Answers to CHAPTER 15 (page 133)**Chapter 15 - Exercise 1 (page 133)**

- a 32 mph b 7 hr c 310 km
d 200 mph e 18 hr f 10 m
g 50 sec
- 648 km
- 62 km/hr
- 2 hr
- 332 mph
- 8 minutes
- 20 km
- a 140 m/min b 2 mins
- 245 miles per day
- 12400 km per day = 517 km/hr
- a 1200 m/hr b 300 m
- a 50 cm/hr b 3 hours
- 3.55 am Sunday

Chapter 15 - Exercise 2 (page 135)

- a 6 miles b $2\frac{1}{2}$ hr c 90 mph
d $58\frac{1}{2}$ km e $5\frac{1}{4}$ hrs f 64 km/hr
- 780 miles
- 8 miles per hour
- 40 m/sec
- $\frac{1}{2}$ hour
- $2\frac{1}{2}$ km
- 60 mph
- 22800 km
- 40 cm/hr
- $6\frac{1}{2}$ hrs
- 429 km
- $2\frac{1}{2}$ hrs
- 112 km/hr
- 10 km/hr
- 2250 m
- $4\frac{1}{2}$ hrs and $4\frac{1}{4}$ hrs. Donald by 15 mins

Chapter 15 - Exercise 3 (page 137)

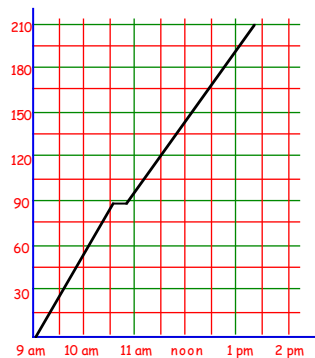
- a 0.1 hr b 0.6 hr c 0.4 hr
d 0.7 hr e 0.2 hr f 0.15 hr
g 0.9 hr h 0.55 hr i 0.3 hr
- a 0.67 hr b 0.13 hr c 0.97 hr
d 0.33 hr e 0.83 hr f 0.22 hr
g 1.17 hr h 1.75 hr
- a 3.75 hr b 1.6 hr c 5.4 hr
d 7.55 hr e 4.85 hr f 2.3 hr
g 9.35 hr h 3.33 hr i 10.05 hr
- 108 km
- a 18 miles b $22\frac{1}{2}$ miles c 20 miles
d 9 miles e 12 miles f 27 miles
- a 24 mk b 25 miles c $3\frac{1}{2}$ km
d 70 miles e 6 km
- Simon - 36 km, Beth - 35 km, Simon - 1 km
- 96 km
- a 43248 mile b 6 miles
c 21 km d 123.5 km
- 5 km/hr
- a 200 mph b 70 km/hr c 420 mph
d 70 mph e 5 km/hr f 4 mph
g 1200 mph h 7 mph

Chapter 15 - Exercise 4 (page 139)

- a 24 mins b 18 mins c 39 mins
d 42 mins e 54 mins f 20 mins
- 3 hr 48 mins
- a 6 hr 18 mins b 2 hr 39 mins
c 4 hr 30 mins d 3 hr 51 mins
e 1 hr 36 mins f 8 hr 40 mins
g 7 hr 54 mins h 1 hr 50 mins
i 15 hrs 12 mins
- a 6 hr 21 min b 9 hr 24 min
c 5 hr 40 min
- a 4.8 hrs b 4 hrs 48 mins
- a 2:1333. hr b 2 hr 8 mins
- a 3 hr 42 min b 20 mins
c 21 mins d 2 hr 45 mins
- a 2 hr 15 mins b 1 hr 45 mins
c 6 hr 30 mins
- a 7 m/sec b 25.2 km/hr
- a 72 km/hr b 180 km/hr
c 1440 km/hr d 45 km/hr
- 14 m/sec = 50.4 km/hr - cheeta faster

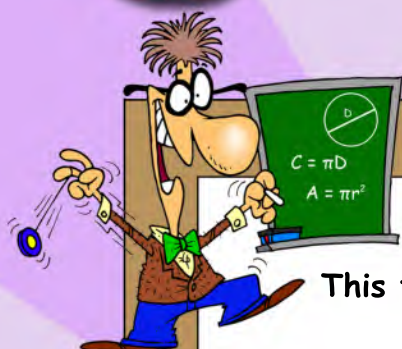
Chapter 15 - Exercise 5 (page 141)

- a $2\frac{1}{2}$ hrs b $\frac{1}{2}$ hr c 1200
d (i) 60 km/hr (ii) 0 km/hr (iii) 30 km/hr
- a 45 mins b 160 km/hr
c 192 km/hr d helped her go faster
- a 10.40 am b 48 km/hr c 144 km/hr
d at 11 am e 24 km
- a B (shallower line)
b (i) 14 km/hr (ii) 28 km/hr
c 1130 d 1430
- a 10 am → (noon, 1 pm) →
(3 pm, 3.40 pm) → 4.40 pm
b (i) 120 km (ii) 100 km
c (i) 60 km/hr (ii) 40 km/hr
(iii) 100 km/hr (iv) 45 km/hr
- a $1\frac{1}{2}$ hrs b 48 mph
c Drove slower
d





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Book 3a